

# Novell® Nterprise™ Linux® Services

COURSE 3015

Novell Training Services

INSTRUCTOR GUIDE

[www.novell.com](http://www.novell.com)

Volume 1

**Novell®**

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# Course Setup

To set up this course, use the following:

- Setup Requirements
- Setup Diagram
- Setup Instructions for the Classroom Computers — *Read carefully before installing your servers*

## Setup Requirements

The following are classroom setup requirements:

**Table Setup-1**

Setup	Minimum Requirements
Setup Time	<ul style="list-style-type: none"><li>■ 4 hours for setup</li><li>■ .5 hour for testing</li></ul>
PCs	<ul style="list-style-type: none"><li>■ <b>Students:</b> 1 server for each student; 1 workstation for each pair of students.</li><li>■ <b>Instructor:</b> 2 servers; 1 workstation.</li></ul>

**Table Setup-1** *(continued)*

Setup	Minimum Requirements
Hardware	<p>Linux® server hardware:</p> <ul style="list-style-type: none"> <li>■ A Pentium® III 750 Mhz or faster computer with</li> <li>■ 512 MB RAM</li> <li>■ 8 GB hard disk space</li> <li>■ CD drive</li> </ul> <p>Windows® XP workstation hardware:</p> <ul style="list-style-type: none"> <li>■ A Pentium® II 266 Mhz or faster computer with</li> <li>■ 128 MB RAM</li> <li>■ 4 GB hard disk space</li> <li>■ CD drive</li> </ul>
Software	<ul style="list-style-type: none"> <li>■ SuSE® Linux Enterprise Server (SLES) 8</li> <li>■ Novell® Nterprise™ Linux® Services (NNLS) 1.0</li> <li>■ Red Carpet Enterprise™</li> <li>■ Windows® XP Home or Professional</li> <li>■ 3015 Course CD (contains exercise files)</li> <li>■ 3015 Setup CD (contains setup files)</li> </ul>



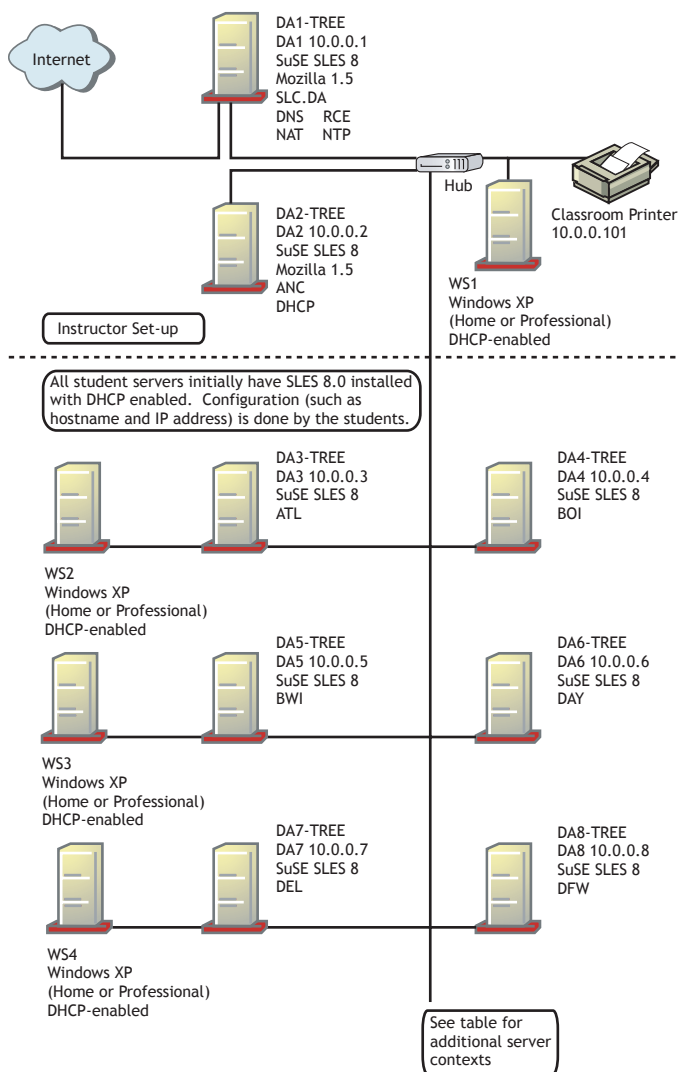
This course was tested on the SuSE Linux Enterprise Server (SLES) 8 distribution. If you attempt to use an unsupported version of SuSE (such as SuSE 9.0), the exercises might not work properly.



## Setup Diagram

Use the following diagram to help you set up your classroom:

**Figure Setup-1**



Install the remainder of the servers not shown in the above figure using the following:

**Table Setup-2**

Server Name	OS	Tree Name	Server Context	TCP/IP Configuration
DA9	SuSE Linux Enterprise Server 8	DA9-TREE	O=GTF	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.9</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA10	SuSE Linux Enterprise Server 8	DA10-TREE	O=IAD	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.10</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA11	SuSE Linux Enterprise Server 8	DA11-TREE	O=IDA	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.11</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA12	SuSE Linux Enterprise Server 8	DA12-TREE	O=LAX	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.12</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>

**Table Setup-2** *(continued)*

Server Name	OS	Tree Name	Server Context	TCP/IP Configuration
DA13	SuSE Linux Enterprise Server 8	DA13-TREE	O=LGA	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.13</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA14	SuSE Linux Enterprise Server 8	DA14-TREE	O=LON	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.14</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA15	SuSE Linux Enterprise Server 8	DA15-TREE	O=MCI	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.15</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA16	SuSE Linux Enterprise Server 8	DA16-TREE	O=MEM	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.16</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA17	SuSE Linux Enterprise Server 8	DA17-TREE	O=MIA	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.17</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>

**Table Setup-2** *(continued)*

Server Name	OS	Tree Name	Server Context	TCP/IP Configuration
DA18	SuSE Linux Enterprise Server 8	DA18-TREE	O=PDX	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.18</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA19	SuSE Linux Enterprise Server 8	DA19-TREE	O=PHX	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.19</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA20	SuSE Linux Enterprise Server 8	DA20-TREE	O=SYD	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.20</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA21	SuSE Linux Enterprise Server 8	DA21-TREE	O=TXL	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.21</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>
DA22	SuSE Linux Enterprise Server 8	DA22-TREE	O=TYO	<ul style="list-style-type: none"> <li>■ Address: 10.0.0.22</li> <li>■ Mask: 255.0.0.0</li> <li>■ Gateway: 10.0.0.1</li> <li>■ DNS: 10.0.0.1</li> </ul>

## Setup Instructions for the Classroom Computers

The classroom setup for this course requires 3 computers for the instructor and 1 server for each student in the class. Each pair of students also shares a Windows XP workstation.

If you have an odd number of students, you should provide the student working alone with a server and a workstation.

The 3 instructor computers serve the following purposes (refer to Figure 1):

- **DA1.** This SuSE Linux Enterprise Server (SLES) 8 server hosts the Red Carpet Enterprise (RCE) service and also provides DNS, NAT, and NTP services for the classroom network.
- **DA2.** This SLES 8 server can be used by the instructor to demonstrate the features and services of NNLS.  
It also provides DHCP services for the classroom network.
- **WS1.** This Windows XP workstation is used to demonstrate the client components of iPrint and iFolder.

Each student is assigned a single computer for course exercises. Students start with a generic Linux server and build an NNLS environment by configuring Linux and installing NNLS components.

The Windows workstation shared by student pairs is used to perform iPrint and iFolder exercises.

To configure the classroom computers, do the following:

- Install and Configure DA1
- Install and Configure DA2
- Install and Configure Student Servers
- Install and Configure Windows XP on the Instructor and Student Workstations
- Configure the Classroom Printer



To save setup time, you can install and configure DA2 at the same time you are installing and configuring DA1.

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### ***Install and Configure DA1***

To install and configure DA1, do the following:

- Install a Second Network Board in DA1
- Install SuSE Linux Enterprise Server (SLES) 8 on DA1
- Install Mozilla 1.5 on DA1
- Configure NAT on DA1
- Configure NTP on DA1
- Configure DNS on DA1
- Install and Configure Ximian Red Carpet Enterprise on DA1

## Install a Second Network Board in DA1

You configure the DA1 server to use NAT to route between the classroom network and your organization's network by using 2 network boards.

Do the following:

1. Install a second network board in DA1.

The first network board in the system (the board assigned the lowest slot number) will be configured as **eth0** and should be connected to your classroom network.

The second network board (the board assigned the highest slot number) will be configured as **eth1** and should be connected to your organizational network.

2. Connect 1 network board to the classroom network; connect the other to your organization's network.

## Install SuSE Linux Enterprise Server (SLES) 8 on DA1

To install SLES 8 on DA1, do the following:

1. Boot the server from the *SuSE SLES 8 CD 1*.
2. In the SuSE Linux Enterprise Server welcome screen, select the highest screen resolution available by pressing **Fx**.

For example, if 1024 x 768 screen resolution is available, press **F5**.

3. Continue by selecting **Installation**.

If you mistakenly use *United Linux CD 1* (instead of the *SuSE SLES 8 CD 1*) installation will start, but you will install United Linux 1.0 without SuSE SLES options available such as YaST configuration tools.

Afterwards, you can complete the SuSE SLES installation by running the script "install\_sles8\_rpms.sh" to install the SLES pms afterwards by running the script "install\_sles8\_rpms.sh" on *SuSE SLES 8 CD 1*.



If your server reboots to the Welcome screen, there might be problems with the display (such as the graphics card driver). Try selecting Installation - Safe Settings.

The Linux kernel begins loading.

After a few moments, a SuSE End User License for SLES appears.

4. Accept the license agreement by selecting **Accept**.
5. In the Language Selection screen, select *your language*; then select **Accept**.
6. Make sure **New Installation** is selected; then select **OK**.

An Installation Settings screen appears with several headings such as Mode, Keyboard Layout, and Mouse.

Each heading (headline) provides a link to a configuration screen you can use to re-configure the installation settings.

7. Make sure the **Mode**, **Keyboard Layout**, and **Mouse** settings are correct.
8. (Conditional) If a setting is not correct, select the heading and make the necessary changes.
9. Make sure that the entire hard disk is used for SuSE by doing the following:
  - a. Select **Partitioning**.
  - b. Select **Create custom partition setup**; then select **Next**.
  - c. Select *your hard disk*; then select **Next**.
  - d. (Conditional) If you receive a message asking if you want to use detected free space, select **No**.
  - e. Select **Use entire hard disk**; then select **Next**.

The original partitions are listed with a “Delete partition” title at the beginning, and the new partitions are listed below the originals.
10. Modify the default **Software** list:
  - a. Select **Software**.

A Software Selection screen appears.

Journaling filesystems may not be accepted by your imaging software.

If you plan on imaging your servers, you should create only partitions with the ext2 filesystem and the swap partition.

For imaging, you should also install the boot loader on the first sector of the hard drive rather than the MBR.



- b. Select **Detailed selection**.

A screen appears with installation options listed on the left and the packages for those options listed on the right.

- c. Make sure only the following options are selected (deselect all others):

- ☐ **Gnome system**
- ☐ **KDE Desktop Environment**
- ☐ **Simple Webserver**
- ☐ **LSB Runtime Environment**
- ☐ **Help & Support Documentation**
- ☐ **Graphical Base System**
- ☐ **YaST2 config modules**
- ☐ **Analyzing Tools**
- ☐ **DHCP and DNS Server**
- ☐ **SLES Administration Tools**

- d. From the Filter drop-down menu (top of the screen), select **Search**.

- e. In the Search field, enter **gettext**; then select **Search**.

- f. On the right in the package list, select **gettext**.

The gettext tool is necessary for some messages from the NNLS installation script to be recorded legibly in the installation log file.

Another tool you might want to include in the installation is the locate tool. You can use locate to search for files and directories.



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After installation, make sure you run **updatedb** from a shell prompt to create the database used by locate.

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- g. In the Search field, enter **locate**; then select **Search**.

h. On the right in the package list, select **findutils-locate**.

i. When you finish, select **Accept**.

You are returned to the Installation Settings screen.

**11.** Select **Time Zone**, and select *your time zone*; then select **Accept**.

**12.** Make sure that the Booting (GRUB) and Language settings are correct.

**13.** (Conditional) If a setting is not correct, select the heading and make the necessary changes.

**14.** When you are satisfied with the installation settings, select **Accept**.

A message appears indicating that YaST2 has all the information necessary to begin installing.

**15.** Start the installation by selecting **Yes, install**.

YaST begins preparing your hard disk and installing SLES 8.

A notify message asks you to insert '*United Linux Version 1.0*' *CD 1*.

**16.** Remove *SuSE SLES 8 CD 1*; then insert *United Linux CD 1*.

**17.** Continue by selecting **OK**.

The installation screen keeps you updated on the installation progress (time remaining and percentage completed).

If your display is the correct resolution, you see a slide show instead of installation information.

**18.** (Optional) View the packages being installed (instead of the slide show) by selecting the **Details** button.

After CD 1 is installed, a notify message asks you to insert '*United Linux Version 1.0*' *CD 2*.

**19.** Remove *United Linux CD 1*; then insert *United Linux CD 2*.

20. Continue by selecting **OK**.

After CD 2 is installed a notify message asks you to insert *'SuSE SLES Version 8' CD 1*.

21. Remove *United Linux CD 2*; then insert *SuSE SLES 8 CD 1*.

22. Continue by selecting **OK**.

After initial installation completes, the system boots, and a password for root screen appears.

23. Enter a root password of **novell** (twice); then select **Next**.

An Add a New User screen appears.

24. Enter the following information:

- ☐ First name: **Student**
- ☐ Last name: **Student**
- ☐ User login: **student**
- ☐ Password: **novell**

25. When you finish, continue by selecting **Next**.

YaST begins analyzing your system.

26. (Conditional) if you receive information messages about your hardware or drivers, respond to these messages by selecting the appropriate option.

For example, if you receive a message that your graphics card is 3D capable, but the selected driver is not, select No when asked if you want to prepare the card for 3D.

A Desktop Settings screen appears.

27. Make sure that **Graphical desktop environment** is selected, and that the correct settings are displayed for your graphics card.

If your monitor is not detected, a Display Configuration dialog appears. Configure your monitor by selecting **Yes**, selecting **Properties**, and selecting or entering the correct properties.



You should have a minimum resolution and color setting of 1024x768@16bit.

---

If you selected Installation - Safe Settings to run the installation program, you might want to select Change, and then lower the Resolution setting to avoid any problems with displaying the graphical desktop environment.

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You can change the resolution and color setting by doing the following:

- a. Select **Change**.
- b. On the left expand **Desktop**; then select **Color and Resolution**.
- c. On the right select **Change Configuration**.
- d. Make sure your desktop is selected; then select **Properties**.  
A dialog appears with tabs for Colors, Resolution, and Expert.
- e. Select **Colors**; then make sure **65536 (16 bit)** is selected from the drop-down list.
- f. Select **Resolution**; then make sure **1024x768** is selected.
- g. When you finish, select **Ok**; then select **Finish**.
- h. Continue by selecting **Finalize >>**,
- i. Test the new configuration by selecting **Test**.  
A test screen appears.



---

If the display is corrupted or does not display at all, press **Ctrl+Alt+Backspace** and try adjusting the colors and resolution again.

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- j. Select **Save**.  
A message indicates that the settings have been saved.
- k. Select **Ok**.

**28.** Continue by selecting **Accept**.

YaST begins configuring your installation, and then analyzes your system.

**29.** When a printer warning message appears, select **Skip detection**.

Installation settings for configurations such as Network Interfaces, Printers, Modems, and ISDN Adaptors appear.

**30.** Configure your classroom network interface card by doing the following:

a. Select **Network interfaces**.

In the Already configured devices list, you should see the built-in network card listed as eth0 with DHCP. This is the card that should be connected to the classroom network.

b. Below the Already configured devices list select **Change**.

A list of configured network cards appears.

c. Make sure *your network card* is selected; then select **Edit**.

d. Select **Static address setup** and enter the following:

- ☐ IP Address: **10.0.0.1**
- ☐ Subnet mask: **255.0.0.0**

e. Select **Host name and name server** and enter the following:

- ☐ Host name: **DA1**
- ☐ Domain name: **digitalairlines.com**

f. When you finish, select **Next**.

You are returned to the Network address setup screen.

g. Select **Routing** and enter the following:

- ☐ Default gateway: **10.0.0.1**

h. Return to the Network address setup screen by selecting **Next**.

i. Return to the Network cards configuration overview by selecting **Next**.

- j. Return to the Installation Settings screen by selecting **Finish**.

**31.** Configure your public network interface card by doing the following:

- a. Select **Network interfaces**.
- b. Below the Network cards to configure, Available Are: list, select **Configure**.

This is your unconfigured network interface card.

- c. In the Network Address Setup window, make sure **eth1** (or eth-pcmcia-0 for laptops) is the Network device name.
- d. Select **Host name and name server**.
- e. In the Name Servers and Domain Search fields enter the name server IP addresses and domain name for your organization.
- f. When you finish, select **Next**.
- g. Select the Setup method that works for your organization (DHCP or Static); then select **Next**.

**32.** Return to the Installation Settings screen by selecting **Finish**.

**33.** Review and verify the installation settings; then select **Next**.

Wait while the configuration settings are written. After a few moments, the system reboots, and the GUI login appears.

**34.** From the Session type drop-down list, select **gnome**.

**35.** Login as **root** with a password of **novell**.

An error message appears indicating that an image for the terminal icon cannot be found.

**36.** Close the error message by selecting **OK**.

**37.** Correct the error by doing the following:

- a. On the top panel of your desktop, right-click the **Terminal** icon; then select **Properties**.

A Launcher Properties dialog appears.

If your mouse is not working properly, try pressing **Ctrl+Alt+F2** and then **Alt+F7** to refresh the GUI display.

- b. Select the **No Icon** button, scroll down and select the **gnome-term-linux.png** file; then select **OK**.
- c. Close the Launcher Properties dialog by selecting **Close**.



---

Make sure you select **Save current setup** the next time you log out to save the icon setting.

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**38.** Remove *SuSE SLES 8 CD 1*.

**39.** Update the database for the locate tool:

- a. Start a terminal session from your desktop by selecting the Terminal icon (on the top panel).  
An xterm window appears with a shell prompt.
- b. Update the locate database by entering **updatedb**.
- c. Log out of the root session by entering **exit**.
- d. Close the xterm window.

**40.** Make sure that the hosts file contains the correct entries:

- a. From the top panel on your desktop, **Applications > SuSE Menu > Office > Editors**; then right-click **KWrite** and select **Add this launcher to panel**.

An icon for KWrite is added to the top panel on your desktop.

- b. Start **KWrite** by selecting the icon.
- c. Select **File > Open**; then browse to and open **/etc/hosts**.
- d. Make sure the following entries appear in the hosts file:

```
127.0.0.1 localhost
```

```
10.0.0.1 DA1.digitalairlines.com DA1
```

- e. Make any changes or additions necessary; then select **File > Quit**.

## Install Mozilla 1.5 on DA1

To run iManager, you need to use a supported web browser such as Mozilla.

For this course, we use Mozilla 1.5, which is provided on your *3015 Setup CD* and the *3015 Course CD*.

To install Mozilla, do the following:

1. From the DA1 server, insert the *3015 Setup CD* in your server's CD drive.
2. On the top panel of your desktop, select the Terminal icon.
3. At the shell prompt enter **mount /media/cdrom**.



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For some CD-ROM drives, you might need to enter **mount -t iso9660 /dev/cdrom /media/cdrom**.

---

4. At the shell prompt change to the /media/cdrom directory prompt by entering **cd /media/cdrom**.
5. At the shell prompt, copy the Mozilla 1.5 installation tarball to the /tmp directory by entering the following:

**cp mozilla-i686-pc-linux-gnu-1.5-sea.tar.gz /tmp**

6. When the copying is complete, unmount the CD by entering **umount /media/cdrom**; then remove the CD from the drive.
7. Change to the /tmp directory by entering **cd /tmp**.
8. At the shell prompt, enter the following:

**tar -zxvf ./mozilla-i686-pc-linux-gnu-1.5-sea.tar.gz**

This creates an installation file set in a directory named “mozilla-installer” in the /tmp directory.

9. Change to the new directory by entering the following:  
**cd mozilla-installer**



10. From the shell prompt start the installation by entering the following:

**./mozilla-installer**

11. Follow the prompts to install Mozilla (do a Typical installation and accept /usr/local/mozilla as the installation directory).

The Mozilla browser window opens.

12. Close the browser window.

13. Close the super user terminal session by entering **exit**; then close the terminal session window.

14. Modify the Mozilla panel icon to launch Mozilla 1.5 by doing the following:

- a. At the top of your desktop, right-click the Mozilla icon; then select **Properties**.

A Launcher Properties dialog appears.

- b. Make sure the **Basic** tab is selected; then enter the following:

□ Name: **Mozilla 1.5**

□ Command: **/usr/local/mozilla/mozilla**

- c. When you finish, select **Close**.

15. Test the Mozilla icon by selecting it.

The Mozilla 1.5 browser opens. However, because NAT and DNS are not configured, no Internet access is available.

16. Check the Mozilla version by selecting **Help > About Mozilla**.

17. Close the browser window.

18. Log out as root by selecting **Actions > Log Out**; then select **Save current setup**.

19. Select **OK**.

20. Select the **gnome** session type; then login as **student** with a password of **novell**.

## Configure NAT on DA1

On your *3015 Setup CD* is a script file that contains the commands necessary to configure DA1 to become a NAT router.

To configure NAT on DA1, do the following:

1. Open a terminal session.
2. Change to the root account by entering **su -** and a password of **novell**.
3. If your *3015 Setup CD* isn't mounted, insert it and mount it by entering **mount /media/cdrom**.
4. Verify that *eth0* is configured for your classroom network and that *eth1* is configured for your organizational network by entering **ifconfig**.

*eth0* should be 10.0.0.1 with 255.0.0.0 as the subnet mask; *eth1* should be configured with the appropriate IP address and subnet mask for your organization.

5. Verify that each card is physically connected to the classroom and organization networks.



---

The script that provides NAT routing for your server is written with the assumption that *eth0* is connected to the classroom network and *eth1* is connected to your organization network.

If this is not so, switch the cables between the 2 network boards.

---

6. Copy **rc.firewall** from the CD to your */etc/init.d* directory by entering **cp /media/cdrom/setup/rc.firewall /etc/init.d**.
7. Change to the */etc/init.d* directory by entering **cd /etc/init.d**.
8. Make the *rc.firewall* script executable by entering **chmod 755 rc.firewall**.
9. At the shell prompt test the script by entering **./rc.firewall**.

10. Make rc.firewall run at boot in run levels 2, 3, and 5 by entering the following:

**chkconfig rc.firewall 235**

11. From the shell prompt reboot the server by entering **reboot**.
12. Verify that the rc.firewall script runs during the boot process.
13. Log in as **student** with a password of **novell (gnome session)**.
14. From a terminal session log in as root by entering **su -** and a password of **novell**.
15. Check the configuration of the rc.firewall script by entering **chkconfig rc.firewall**.



After DA3 is installed, you will verify that NAT is working properly.

---

### Configure NTP on DA1

The student servers use NTP to synchronize their server time with DA1.



The following steps only work if you have Internet access.

---

To enable NTP on DA1, do the following:

1. At a shell prompt, check the time on DA1 and verify that it is within 1-2 minutes of the correct time by entering **date**.

If you need to adjust the system time, enter **date MMDDhhmmYYYY** where **MM** is the current month, **DD** is the current day, **hh** is the current hour, **mm** is the current minute, and **YYYY** is the current year.

2. At the shell prompt, enter **ntpdate** followed by one of the following **IP addresses** for public stratum 2 NTP servers:
  - ❑ **128.59.16.20** (Columbia University)
  - ❑ **128.105.37.11** (University of Wisconsin)
  - ❑ **128.249.1.10** (Baylor University, Texas)
  - ❑ **131.216.22.15** (University of Nevada Las Vegas)



You might need to run this command several times. The time offset returned should be less than 1 second.

If you do not configure the `/etc/ntp.conf` file, DA1 will synchronize to its own clock at stratum 11; students will synchronize at stratum 12.

If these addresses are unavailable, visit <http://www.eecis.udel.edu/~mills/ntp/clock2a.html> for a complete list of publicly available NTP time sources.

3. In the `/etc/ntp.conf` file, make (and save) the following changes:
  - a. Edit the **server 127.127.1.0** line to point to a publicly accessible NTP time source (including those listed in step 2) using the following format:

**server IP\_address**

For example, if you are using Columbia University as your NTP time source, you would enter

**server 128.59.16.20**

A complete list of servers is available at <http://www.eecis.udel.edu/~mills/ntp/clock2a.html>.



If you use one of these servers to synchronize time using the `ntpd` daemon, be sure to send an email to the administrator of the time server to notify him or her that you are using their system.

- b. Comment out the **fudge** line.

4. From a root terminal session, load the ntpd daemon on DA1 by entering **rcxntpd start**.

The daemon will attempt to get an initial date and time from the NTP server you configured, and will return a “failed” message. However, you can ignore the message, as the date and time are retrieved for you.

5. Configure the ntpd daemon to automatically start when the server boots by entering **chkconfig xntpd 2345**.
6. Verify that your server gets synchronized by entering **ntptrace**.

You might need to enter ntptrace more than once for the trace to connect to your time source and return a stratum level. It can require up to 5 minutes for the trace to complete.

### Configure DNS on DA1

DA1 functions as a DNS server for the classroom network using the named daemon.

To configure DNS on DA1, do the following:

1. Open a terminal session.
2. Change to the root account by entering **su -** and a password of **novell**.
3. If your *3015 Setup CD* isn't mounted, mount it by entering **mount /media/cdrom**.
4. Copy the hosts files from the *3015 Setup CD* to /var/named by entering the following:  
**cp /media/cdrom/setup/\*.hosts /var/named**
5. Set permissions on the hosts files by entering the following:  
**chmod 644 /var/named/\*.hosts**
6. Copy the named.conf file from the *3015 Setup CD* to /etc by entering **cp /media/cdrom/setup/named.conf /etc**.

If you're having trouble starting the named daemon, enter **tail /var/log/messages** to see any error messages that might have been logged.

7. Load the named service by entering **rcnamed start**.
8. Configure named to load when the server boots by entering **chkconfig named 2345**.

### Install and Configure Ximian Red Carpet Enterprise on DA1

Novell provides a Red Carpet Enterprise (RCE) server for customers to download and install patches to Novell Nterprise Linux Services (NNLS). These patches are installed by the Red Carpet daemon that is part of NNLS.

However, for instructional purposes (and to avoid patches that change exercise steps), you set up an RCE server for classroom use.

To set up the RCE server, do the following:

1. Open a terminal session and change to the root account by entering **su -** and a password of **novell**.
2. Make sure the *3015 Setup CD* is inserted and mounted on your SLES 8 server.
3. Copy the Red Carpet license **server.key** file from the CD to the /tmp directory by entering the following:  
**cp /media/cdrom/RCE/server.key /tmp**
4. When you finish copying the file, unmount the CD by entering **umount /media/cdrom**.
5. Remove the *3015 Setup CD* from your CD drive; then insert the *Red Carpet Enterprise CD* in your server's CD drive.
6. Mount the CD by entering **mount /media/cdrom**.
7. Enter **cd /media/cdrom**.
8. Start the install by entering **./rce-install**.
9. When prompted to install Red Carpet Enterprise, enter **y**.

10. When presented with the license agreement, press **Space** until prompted to accept the license agreement; then enter **y**.
11. When prompted to supply the path to the license file, enter **/tmp/server.key**.
12. When asked if the server has access to the Internet, enter **n**.
13. When asked if you want to leave rug and rcd after installation, enter **y**.  
Wait while files are copied.

This starts the Red Carpet server.

Enter the information in Step 16 very carefully. If misspelled, you won't be able to log in. If this happens, you can reinitialize the database by entering **rce-init -f** at the command prompt. Return to Step 15 and re-enter the information in the Initial Configuration screen.

14. At the shell prompt enter **/usr/sbin/rce-init**.  
Wait while the server is initialized.
15. Open a Mozilla browser window and go to the Red Carpet Enterprise web page at **http://10.0.0.1**.
16. In the Initial Configuration window, enter the following:
  - ❑ Name: **admin**
  - ❑ Username (E-Mail): **admin@digitalairlines.com**
  - ❑ Password: **novell**
  - ❑ Confirm Password: **novell**
17. Select **Initialize Database**.
18. In the Login window, authenticate as **admin@digitalairlines.com** with a password of **novell**.
19. From the options on the left, select **Channels**.
20. Select **Create New Channel**.
21. To create your new channel, enter the following:
  - ❑ Name: **3015**
  - ❑ Description: **NNLS Updates**
  - ❑ Alias: **3015**

**22. Select **Save**.**

A message indicates that you have successfully added 3015.

**23. Create a group by selecting **Groups**.****24. Select **Create New Group**.****25. Enter the following:**

- ☐ Name: **3015 Class**
- ☐ Description: **NNLS Updates**

**26. Select **Add**.**

An Edit Group window appears with a message that indicates you have successfully created 3015 Class.

**27. Generate an activation key for members of this group by selecting **Members**.****28. Select **Generate New Key**.****29. When an *Activation key number* appears in the Key field, write it down for students to use in Exercise 2-2.****30. Limit the distributions that can connect to the 3015 channel by selecting **Channels**.****31. Select **Distributions** (next to the penguin icon).****32. Select **Not Shown** for every distribution except **sles-8-i386**; then select **Save**.****33. Unmount the *Red Carpet Enterprise* CD; then mount the *3015 Setup* CD.****34. In the Red Carpet web page, add update packages by selecting **Channels** again.****35. Select **3015**.****36. Select **Add Package**.****37. In the All Platforms window, select **sles-8-i386**; then select the **Add** arrow.**

The activation key number is case sensitive. The dashes must be included as well.



38. Select **Browse** and navigate to **/media/cdrom/RCE**.
39. Select **novell-netstorage-3.0.0-18.i386.rpm**; then select **Open**.
40. In the Importance drop-down menu, select **Necessary**; then select **Save**.
41. Add the 3015 Class group to the 3015 channel by selecting **Channels** again.
42. Select **3015**.
43. Scroll down to the Groups field and notice that 3015 Class is in the drop-down menu.
44. Select **Add Group**.

The channel, group, and updated package are ready for Exercise 2-2.

### ***Install and Configure DA2***

To install and configure DA2, do the following:

- Install SuSE Linux Enterprise Server 8 on DA2
- Install Mozilla 1.5 on DA2
- Configure DHCP on DA2

### **Install SuSE Linux Enterprise Server 8 on DA2**

To install SLES 8 on DA2, do the following:

1. Boot the server from *SuSE SLES 8 CD 1*.
2. In the SuSE Linux Enterprise Server welcome screen, select the highest screen resolution available by pressing **Fx**.

For example, if 1024 x 768 screen resolution is available, press **F5**.

3. Continue by selecting **Installation**.



---

If your server reboots to the Welcome screen, there might be problems with the display (such as the graphics card driver). Try selecting Installation - Safe Settings.

---

The Linux kernel begins loading.

After a few moments, a SuSE End User License for SLES appears.

4. Accept the license agreement by selecting **Accept**.
5. In the Language Selection screen, select *your language*; then select **Accept**.
6. Make sure **New Installation** is selected; then select **OK**.

An Installation Settings screen appears with several headings such as Mode, Keyboard Layout, and Mouse.

Each heading (headline) provides a link to a configuration screen you can use to re-configure the installation settings.

7. Make sure the **Mode**, **Keyboard Layout**, and **Mouse** settings are correct.
8. (Conditional) If a setting is not correct, select the heading and make the necessary changes.

Journaling filesystems may not be accepted by your imaging software.

If you plan on imaging your servers, you should create only partitions with the ext2 filesystem and the swap partition.

For imaging, you should also install the boot loader on the first sector of the hard drive rather than the MBR.

9. Make sure that the entire hard disk is used for SLES by doing the following:
  - a. Select **Partitioning**.
  - b. Select **Create custom partition setup**; then select **Next**.
  - c. Select ***your hard disk***; then select **Next**.
  - d. (Conditional) If you receive a message asking if you want to use detected free space, select **No**.
  - e. Select **Use entire hard disk**; then select **Next**.

The original partitions are listed with a “Delete partition” title at the beginning and the new partitions are listed below the originals.
10. Modify the default **Software** list:
  - a. Select **Software**.

A Software Selection screen appears.
  - b. Select **Detailed selection**.

A screen appears with installation options listed on the left and the packages for those options listed on the right.
  - c. Make sure only the following options are selected (deselect all others):
    - ☐ **Gnome system**
    - ☐ **KDE Desktop Environment**
    - ☐ **LSB Runtime Environment**
    - ☐ **Help & Support Documentation**
    - ☐ **Graphical Base System**
    - ☐ **YaST2 config modules**
    - ☐ **Analyzing Tools**
    - ☐ **DHCP and DNS Server**
    - ☐ **SLES Administration Tools**
  - d. From the Filter drop-down menu (top of the screen), select **Search**.

- e. In the Search field, enter **gettext**; then select **Search**.
- f. On the right in the package list, select **gettext**.

The gettext tool is necessary for some messages from the NNLS installation script to be recorded legibly in the installation log file.

Another tool you might want to include in the installation is the locate tool. You can use locate to search for files and directories.



---

After installation, make sure you run **updatedb** from a shell prompt to create the database used by locate.

---

- g. In the Search field, enter **locate**; then select **Search**.
- h. On the right in the package list, select **findutils-locate**.
- i. When you finish, select **Accept**.

You are returned to the Installation Settings screen.

- 11. Select **Time Zone**, and select ***your time zone***; then select **Accept**.
- 12. Make sure that the Booting and Language settings are correct.
- 13. (Conditional) If a setting is not correct, select the heading and make the necessary changes.
- 14. When you are satisfied with the installation settings, select **Accept**.

A message appears indicating that YaST2 has all the information necessary to begin installing.

- 15. Start the installation by selecting **Yes, install**.

YaST begins preparing your hard disk and installing SLES 8.

A notify message asks you to insert '*United Linux Version 1.0*' CD 1.

- 16. Remove *SuSE SLES 8 CD 1*; then insert *United Linux CD 1*.

**17. Continue by selecting **OK**.**

The installation screen keeps you updated on the installation progress (time remaining and percentage completed).

If your display is the correct resolution, you see a slide show instead of installation information.

**18. (Optional) View the packages being installed (instead of the slide show) by selecting the **Details** button.**

After CD 1 is installed, a notify message asks you to insert *'United Linux Version 1.0' CD 2*.

**19. Remove *United Linux CD 1*; then insert *United Linux CD 2*.****20. Continue by selecting **OK**.**

After CD 2 is installed a notify message asks you to insert *'SuSE SLES Version 8' CD 1*.

**21. Remove *United Linux CD 2*; then insert *SuSE SLES 8 CD 1*.****22. Continue by selecting **OK**.**

After initial installation completes, the system boots, and a password for root screen appears.

**23. Enter a root password of **novell** (twice); then select **Next**.**

An Add a New User screen appears.

**24. Enter the following information:**

- ☐ First name: **Student**
- ☐ Last name: **Student**
- ☐ User login: **student**
- ☐ Password: **novell**

**25. When you finish, continue by selecting **Next**.**

YaST begins analyzing your system.

If your monitor is not detected, a Display Configuration dialog appears. Configure your monitor by selecting **Yes**, selecting **Properties**, and selecting or entering the correct properties.



26. (Conditional) if you receive information messages about your hardware or drivers, respond to these messages by selecting the appropriate option.

For example, if you receive a message that your graphics card is 3D capable, but the selected driver is not, select No when asked if you want to prepare the card for 3D.

A Desktop Settings screen appears.

27. Make sure that **Graphical desktop environment** is selected, and that the correct settings are displayed for your graphics card.

You should have a minimum resolution and color setting of 1024x768@16bit.

---

If you selected Installation - Safe Settings to run the installation program, you might want to select Change, and then lower the Resolution setting to avoid any problems with displaying the graphical desktop environment.

---

You can change the resolution and color setting by doing the following:

- a. Select **Change**.
- b. On the left expand **Desktop**; then select **Color and Resolution**.
- c. On the right select **Change Configuration**.
- d. Make sure your desktop is selected; then select **Properties**.  
A dialog appears with tabs for Colors, Resolution, and Expert.
- e. Select **Colors**; then make sure **65536 (16 bit)** is selected from the drop-down list.
- f. Select **Resolution**; then make sure **1024x768** is selected.
- g. When you finish, select **Ok**; then select **Finish**.
- h. Continue by selecting **Finalize >>**,

- i. Test the new configuration by selecting **Test**.

A test screen appears.



---

If the display is corrupted or does not display at all, press **Ctrl+Alt+Backspace** and try adjusting the colors and resolution again.

---

- j. Select **Save**.

A message indicates that the settings have been saved.

- k. Select **Ok**.

**28. Continue by selecting **Accept**.**

YaST begins configuring your installation, and then analyzes your system.

**29. When a printer warning message appears, select **Skip detection**.**

Installation settings for Network Interfaces, Printers, Modems, and ISDN Adaptors appear.

**30. Configure **Network interfaces** by doing the following:**

- a. Select **Network interfaces**.
- b. Below the Already configured devices list select **Change**.  
A list of configured network cards appears.
- c. Make sure ***your network card*** is selected; then select **Edit**.
- d. Select **Static address setup** and enter the following:
  - ❑ IP Address: **10.0.0.2**
  - ❑ Subnet mask: **255.0.0.0**
- e. Select **Host name and name server** and enter the following:
  - ❑ Host name: **DA2**
  - ❑ Domain name: **anc.digitalairlines.com**
  - ❑ Name server 1: **10.0.0.1**

If your mouse is not working properly, try pressing **Ctrl+Alt+F2** and then **Alt+F7** to refresh the GUI display.

- f. When you finish, select **Next**.

You are returned to the Network address setup screen.

- g. Select **Routing** and enter the following:

- Default gateway: **10.0.0.1**

- 31. Return to the Network address setup screen by selecting **Next**.
- 32. Return to the Network cards configuration overview by selecting **Next**.
- 33. Return to the Installation Settings screen by selecting **Finish**.
- 34. Select **Next**.

Wait while the configuration settings are written. After a few moments, the system reboots, and the GUI login appears.

- 35. From the Session type drop-down list, select **gnome**.
- 36. Login as **root** with a password of **novell**.

An error message appears indicating that an image for the terminal icon cannot be found.

- 37. Close the error message by selecting **OK**.
- 38. Correct the error by doing the following:
  - a. On the top panel of your desktop, right-click the **Terminal** icon; then select **Properties**.  
A Launcher Properties dialog appears.
  - b. Select the **No Icon** button, scroll down and select the **gnome-term-linux.png** file; then select **OK**.
  - c. Close the Launcher Properties dialog by selecting **Close**.



Make sure you select **Save current setup** the next time you log out to save the icon setting.

- 39. Remove the *SuSE SLES 8 CD 1*.



**40.** Update the database for the locate tool:

- a. Start a terminal session from your desktop by selecting the Terminal icon (on the top panel).

An xterm window appears with a shell prompt.

- b. Update the locate database by entering **updatedb**.
- c. Log out of the root session by entering **exit**.
- d. Close the xterm window.

**41.** Make sure that the hosts file contains the correct entries:

- a. From the top panel on your desktop, **Applications > SuSE Menu > Office > Editors**; then right-click **KWrite** and select **Add this launcher to panel**.

An icon for KWrite is added to the top panel on your desktop.

- b. Start **KWrite** by selecting the icon.
- c. Select **File > Open**; then browse to and open **/etc/hosts**.
- d. Make sure the following entries appear in the hosts file:

**127.0.0.1 localhost**

**10.0.0.2 DA2.anc.digitalairlines.com DA2**

- e. Make any changes or additions necessary; then select **File > Quit**.

**Install Mozilla 1.5 on DA2**

In order for iManager to run properly, you need to use a supported web browser such as Mozilla.

For this course, we use Mozilla 1.5, which is provided on your *3015 Setup CD* and the *3015 Course CD*.

To install Mozilla, do the following:

1. From the DA2 server, insert the *3015 Setup CD* in your server's CD drive.
2. On the top panel of your desktop, select the Terminal icon.
3. At the shell prompt enter **mount /media/cdrom**.



---

For some CD-ROM drives, you might need to enter **mount -t iso9660 /dev/cdrom /media/cdrom**.

---

4. At the shell prompt change to the /media/cdrom directory by entering **cd /media/cdrom**.
5. At the shell prompt copy the Mozilla 1.5 installation tarball to the /tmp directory by entering the following:

**cp mozilla-i686-pc-linux-gnu-1.5-sea.tar.gz /tmp**

6. When the copying is complete, unmount the CD by entering **umount /media/cdrom**; then remove the CD from the drive.
7. Change directories to the /tmp directory by entering **cd /tmp**.
8. At the shell prompt, enter the following:

**tar -zxvf ./mozilla-i686-pc-linux-gnu-1.5-sea.tar.gz**

This creates an installation file set in a directory named "mozilla-installer" in the /tmp directory.

9. Change to the new directory by entering the following:
10. From the shell prompt start the installation by entering the following:

**cd mozilla-installer**

**./mozilla-installer**

11. Follow the prompts to install Mozilla (do a Typical installation and accept /usr/local/mozilla as the installation directory).

The Mozilla browser window opens.

12. Close the browser window; then close the terminal session window.
13. Modify the Mozilla panel icon to launch Mozilla 1.5 by doing the following:
  - a. At the top of your desktop, right-click the Mozilla icon; then select **Properties**.  
A Launcher Properties dialog appears.
  - b. Make sure the **Basic** tab is selected; then enter the following:
    - Name: **Mozilla 1.5**
    - Command: **/usr/local/mozilla/mozilla**
  - c. When you finish, select **Close**.
14. Test the Mozilla icon by selecting it.  
The Mozilla 1.5 browser opens. However, if NAT and DNS are not configured yet, no Internet access will be available.
15. Check the Mozilla version by selecting **Help > About Mozilla**.
16. Close the browser window.
17. Log out as root by selecting **Actions > Log Out**; then select **Save current setup**.
18. Select **OK**.
19. Select the **gnome** session type; then login as **student** with a password of **novell**.

### Configure DHCP on DA2

DA2 functions as the classroom DHCP server.

To configure the dhcpd daemon on DA2, do the following:

1. Open a terminal session and log in as root by entering **su -** with a password of **novell**.

If you're having trouble starting the dhcpd daemon, enter **tail /var/log/messages** to see any error messages that might have been logged.

2. On DA2, insert your *3015 Setup CD* and mount it by entering **mount /media/cdrom**.
3. Copy the dhcpd.conf file from the CD to /etc by entering **cp /media/cdrom/Setup/dhcpd.conf /etc**.
4. Unmount the *3015 Setup CD* by entering **umount /media/cdrom**; then remove the CD from the drive.
5. Start the dhcpd daemon by entering **rcdhcpd start**.
6. Configure the dhcpd daemon to start automatically when the server is booted by entering **chkconfig dhcpd 2345**.
7. Verify the setting by entering **chkconfig dhcpd**.
8. Close the terminal session window.

### ***Install and Configure Student Servers***

In this course, you provide students with a basic Linux server setup that they configure to use with NNLS.

To set up the student servers, do the following:

- Install SuSE Linux Enterprise Server 8 on DA3
- Test the Instructor Server Setup
- Set Up the Remaining Student Servers

#### **Install SuSE Linux Enterprise Server 8 on DA3**

To install SLES 8 on DA3, do the following:

1. Boot the server from *SuSE SLES 8 CD 1*.
2. In the SuSE Linux Enterprise Server welcome screen, select the highest screen resolution available by pressing **Fx**.

After building the student Linux servers, make sure the servers are turned off before starting class.

This helps prevent experienced Linux students from making changes to the server that can impact NNLS.

It also prepares students for Exercise 1-1 where they are instructed to turn on their Linux servers.

For example, if 1024 x 768 screen resolution is available, press **F5**.

3. Continue by selecting **Installation**.



If your server reboots to the Welcome screen, there might be problems with the display (such as the graphics card driver). Try selecting Installation - Safe Settings.

The Linux kernel begins loading.

After a few moments, a SuSE End User License for SLES appears.

4. Accept the license agreement by selecting **Accept**.
5. In the Language Selection screen, select *your language*; then select **Accept**.
6. Make sure **New Installation** is selected; then select **OK**.

An Installation Settings screen appears with several headings such as Mode, Keyboard Layout, and Mouse.

Each heading (headline) provides a link to a configuration screen you can use to re-configure the installation settings.

7. Make sure the **Mode**, **Keyboard Layout**, and **Mouse** settings are correct.
8. (Conditional) If a setting is not correct, select the heading and make the necessary changes.

Journaling filesystems may not be accepted by your imaging software.

If you plan on imaging your servers, you should create only partitions with the ext2 filesystem and the swap partition.

For imaging, you should also install the boot loader on the first sector of the hard drive rather than the MBR.

9. Make sure that the entire hard disk is used for SLES by doing the following:

- a. Select **Partitioning**.
- b. Select **Create custom partition setup**; then select **Next**.
- c. Select ***your hard disk***; then select **Next**.
- d. (Conditional) If you receive a message asking if you want to use detected free space, select **No**.
- e. Select **Use entire hard disk**; then select **Next**.

The original partitions are listed with a “Delete partition” title at the beginning, and the new partitions are listed below the originals.

10. Modify the default **Software** list:

- a. Select **Software**.  
A Software Selection screen appears.
- b. Select **Detailed selection**.  
A screen appears with installation options listed on the left and the packages for those options listed on the right.
- c. Make sure only the following options are selected (deselect all others):
  - ☐ **C/C++ Compiler and Tools**
  - ☐ **Gnome system**
  - ☐ **KDE Desktop Environment**
  - ☐ **LSB Runtime Environment**
  - ☐ **Help & Support Documentation**
  - ☐ **Graphical Base System**
  - ☐ **YaST2 config modules**
  - ☐ **Analyzing Tools**
  - ☐ **SLES Administration Tools**

Make sure that Simple Webserver *is not* selected (it can cause problems with NNLS).

- d. From the Filter drop-down menu (top of the screen), select **Search**.
- e. In the Search field, enter **locate**; then select **Search**.
- f. On the right in the package list, select **findutils-locate**.



---

After installation, make sure you run **updatedb** from a shell prompt to create the database used by locate.

---

- g. When you finish, select **Accept**.

You are returned to the Installation Settings screen.

11. Select **Time Zone**, and select *your time zone*; then select **Accept**.
12. Make sure that the Booting and Language settings are correct.
13. (Conditional) If a setting is not correct, select the heading and make the necessary changes.
14. When you are satisfied with the installation settings, select **Accept**.

A message appears indicating that YaST2 has all the information necessary to begin installing.

15. Start the installation by selecting **Yes, install**.

YaST begins preparing your hard disk and installing SLES 8.

A notify message asks you to insert '*United Linux Version 1.0*' CD 1.

16. Remove *SuSE SLES 8 CD 1*; then insert *United Linux CD 1*.
17. Continue by selecting **OK**.

The installation screen keeps you updated on the installation progress (time remaining and percentage completed).

If your display is the correct resolution, you see a slide show instead of installation information.

18. (Optional) View the packages being installed (instead of the slide show) by selecting the **Details** button.

After CD 1 is installed, a notify message asks you to insert *'United Linux Version 1.0' CD 2*.

19. Remove *United Linux CD 1*; then insert *United Linux CD 2*.

20. Continue by selecting **OK**.

After CD 2 is installed a notify message asks you to insert *'SuSE SLES Version 8' CD 1*.

21. Remove *United Linux CD 2*; then insert *SuSE SLES 8 CD 1*.

22. Continue by selecting **OK**.

After initial installation completes, the system boots, and a password for root screen appears.

23. Enter a root password of **novell** (twice); then select **Next**.

An Add a New User screen appears.

24. Enter the following information:

- ☐ First name: **Student**
- ☐ Last name: **Student**
- ☐ User login: **student**
- ☐ Password: **novell**

25. When you finish, continue by selecting **Next**.

YaST begins analyzing your system.

26. (Conditional) if you receive information messages about your hardware or drivers, respond to these messages by selecting the appropriate option.

For example, if you receive a message that your graphics card is 3D capable, but the selected driver is not, select No when asked if you want to prepare the card for 3D.

A Desktop Settings screen appears.



If your monitor is not detected, a Display Configuration dialog appears. Configure your monitor by selecting **Yes**, selecting **Properties**, and selecting or entering the correct properties.



27. Make sure that **Graphical desktop environment** is selected, and that the correct settings are displayed for your graphics card.

You should have a minimum resolution and color setting of 1024x768@16bit.

---

If you selected Installation - Safe Settings to run the installation program, you might want to select **Change**, and then lower the Resolution setting to avoid any problems with displaying the graphical desktop environment.

---

You can change the resolution and color setting by doing the following:

- a. Select **Change**.
- b. On the left expand **Desktop**; then select **Color and Resolution**.
- c. On the right select **Change Configuration**.
- d. Make sure your desktop is selected; then select **Properties**.  
A dialog appears with tabs for Colors, Resolution, and Expert.
- e. Select **Colors**; then make sure **65536 (16 bit)** is selected from the drop-down list.
- f. Select **Resolution**; then make sure **1024x768** is selected.
- g. When you finish, select **Ok**; then select **Finish**.
- h. Continue by selecting **Finalize >>**,
- i. Test the new configuration by selecting **Test**.  
A test screen appears.



---

If the display is corrupted or does not display at all, press **Ctrl+Alt+Backspace** and try adjusting the colors and resolution again.

---

- j. Select **Save**.

A message indicates that the settings have been saved.

- k. Select **Ok**.

**28.** Continue by selecting **Accept**.

YaST begins configuring your installation, and then analyzes your system.

**29.** When a printer warning message appears, select **Skip detection**.

Installation settings for Network Interfaces, Printers, Modems, and ISDN Adaptors appear.

**30.** Make sure the network interface card is configured for DHCP by reviewing the information for Network interfaces.

If you need to configure your network interface card for DHCP, do the following:

- a. Select **Network interfaces**.
- b. Below the Already configured devices list select **Change**.  
A list of configured network cards appears.
- c. Make sure ***your network card*** is selected; then select **Edit**.
- d. Make sure **Automatic address setup (via DHCP)** is selected.
- e. Return to the Network cards configuration overview by selecting **Next**.
- f. Return to the Installation Settings screen by selecting **Finish**.

**31.** Make sure the installation settings are correct; then select **Next**.

Wait while the configuration settings are written. After a few moments, the GUI login appears.

**32.** From the Session type drop-down list, select **gnome**.

**33.** Login as **root** with a password of **novell**.

An error message appears indicating that an image for the terminal icon cannot be found.

If your mouse is not working properly, try pressing **Ctrl+Alt+F2** and then **Alt+F7** to refresh the GUI display.

34. Close the error message by selecting **OK**.
35. Correct the error by doing the following:
  - a. On the top panel of your desktop, right-click the **Terminal** icon; then select **Properties**.  
A Launcher Properties dialog appears.
  - b. Select the **No Icon** button, scroll down and select the **gnome-term-linux.png** file; then select **OK**.
  - c. Close the Launcher Properties dialog by selecting **Close**.
36. Remove *SuSE SLES 8 CD 1*.
37. Start a terminal session from your desktop by selecting the Terminal icon (on the top panel).  
An xterm window appears with a shell prompt.
38. Update the locate database by entering **updatedb**.
39. Close the xterm by entering **exit**.
40. Log out as root and log in as student:
  - a. Select **Actions > Log Out**.
  - b. Select **Save current setup**; then select **OK**.
  - c. From the Session type drop-down list, select **gnome**.
  - d. Login as **student** with a password of **novell**.

### Test the Instructor Server Setup

To test the instructor server setup on DA1 and DA2, do the following:

1. From the DA3 server, make sure you are logged in as **student** with a password of **novell**.
2. Open a terminal session and change to the root account by entering **su -** and a password of **novell**.

3. Test the DA1 and DA2 setup by doing the following:
  - a. Verify that DHCP is working by entering **ifconfig**.  
Ensure that the server is receiving an IP address as well as gateway and DNS server addresses from the dhcpd daemon on DA2.
  - b. Verify that NAT is working properly by entering **traceroute 128.59.16.20**.  
Ensure that routing is operating correctly.
  - c. Verify that DNS is working properly by entering **nslookup -sil da2.anc.DigitalAirlines.com**.  
Ensure that the named daemon on DA1 returns an address of **10.0.0.2**.

### Set Up the Remaining Student Servers

To set up the remaining Linux servers for students, do the following:

1. From the DA3 server, make sure you are logged in as **student** with a password of **novell**.
2. Open a terminal session and enter **halt**.
3. Wait while the system shuts down.
4. Using your preferred imaging software, image DA3 to the remaining student servers.

You can also install Linux on the remaining student servers manually using the steps under “Install SuSE Linux Enterprise Server 8 on DA3” on Setup-38.

### ***Install and Configure Windows XP on the Instructor and Student Workstations***

Install Windows XP using the following parameters:

**Table Setup-3**

<b>Workstation Name</b>	<b>Administrator Password</b>	<b>TCP/IP Configuration</b>
<b>WS1</b>	<b>novell</b>	DHCP
<b>WS2</b>	<b>novell</b>	DHCP
<b>WS3</b>	<b>novell</b>	DHCP
<b>WS4</b>	<b>novell</b>	DHCP
<b>WS5</b>	<b>novell</b>	DHCP
<b>WS6</b>	<b>novell</b>	DHCP
<b>WS7</b>	<b>novell</b>	DHCP
<b>WS8</b>	<b>novell</b>	DHCP
<b>WS9</b>	<b>novell</b>	DHCP
<b>WS10</b>	<b>novell</b>	DHCP
<b>WS11</b>	<b>novell</b>	DHCP
<b>WS12</b>	<b>novell</b>	DHCP

### ***Configure the Classroom Printer***

The iPrint exercises in this course require the use of a network printer. You should use a printer that has a network interface.

To configure the classroom printer, do the following:

1. Connect the classroom printer to the classroom network.
2. Assign the classroom printer an IP address of **10.0.0.101** and a subnet mask of **255.0.0.0**.
3. Locate and test the ***printer driver*** to be used in the iPrint exercises in this course to make sure it is compatible with your printer.

# Introduction

In this course you learn the Novell® Nterprise™ Linux® Services (NNLS) installation and configuration skills necessary to prepare you to take the Novell® Certified Linux® Engineer (CLE) certification practicum test.

The final day of class is reserved for building an NNLS solution on your own to prepare for taking the CLE practicum.

## Audience

This course serves as the introductory course for the Novell Nterprise Linux Services solution.

While the primary audience for this course is the current Novell CNE<sup>SM</sup>, Linux professionals, and Novell CNA<sup>SM</sup> with basic eDirectory™ knowledge can also use this course to prepare for the Novell CLE Practicum.

As the CLE practicum prerequisites may evolve over time, we recommend that you review the prerequisites listed at <http://www.novell.com/education/certinfo> before teaching each instance of this class.

In addition, we recommend (when possible) that you display (or point students to) the current prerequisites at the above web site when teaching this section of the course.

## Certification and Prerequisites

This course helps you prepare for the Novell Certified Linux Engineer (CLE) Practical Test, called the *practicum*.

The practicum tests you on objectives in this course (Novell Nterprise Linux Services - Course 3015) and knowledge in the following areas:

- Fundamentals of networking
- eDirectory fundamentals
- Linux fundamentals (LPI Level 1 certification)

While some networking, eDirectory, and Linux fundamentals are briefly reviewed in this course, prerequisite training or experience in these areas is required in order to successfully pass the Novell CLE practicum.

For more about Novell certification programs and taking the CLE practicum, see <http://www.novell.com/education/certinfo>.

## Linux Distributions

Current Novell policy regarding support of Linux distributions only recognizes enterprise distributions of Red Hat® (AS 2.1 or ES 2.1) and SuSE® SLES 8 as being fully tested and supported by Novell.

Testing and support of other Red Hat and SuSE distributions is limited, and no guarantees are made that NNLS products will function properly on these distributions.



Make sure you emphasize this point. If there are students who have already modified the installation of Linux, you might need to re-image or re-install their servers.

In addition, NNLS is only supported on a clean installation of Linux. Installing other products or services can result in problems with the performance of NNLS.

## NNLS and Web Browser Support

Only Microsoft® Internet Explorer is officially supported by Novell as the web browser for use with all NNLS products. However, Mozilla 1.4 or later is supported by iManager and eDirectory.

For the purposes of classroom instruction, we provide both Mozilla 1.5 and Internet Explorer to complete exercises. All exercises have been tested on Mozilla 1.5, and there are only a few instances where Internet Explorer is required.

However, we recommend using Internet Explorer in a production environment to avoid any problems that can arise from using an unsupported product.

## NNLS Licensing

The copy of NNLS you receive in your student kit is a fully functioning copy of the NNLS product. You are also provided with a 250,000 user evaluation license for eDirectory. You will need the license when installing NNLS.

The student copy of NNLS (and the associated license) are evaluation copies and do not entitle you to any support from Novell. You must purchase NNLS from Novell (or an authorized dealer) to receive a certificate for official Novell support.



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You can obtain your own 250,000 user evaluation eDirectory license for free at [http://www.novell.com/products/edirectory/customer\\_license.htm](http://www.novell.com/products/edirectory/customer_license.htm).

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## NNLS Online Resources

Novell provides a variety of online resources to help you configure and implement NNLS.

These include the following:

- [http://www.novell.com/linux/nterprise\\_linux\\_services.html](http://www.novell.com/linux/nterprise_linux_services.html)

This is the Novell home page for Novell Nterprise Linux Services.

- <http://www.novell.com/documentation/lg/nnls>

This is the Novell Documentation web site for NNLS.

- <http://www.novell.com/cool solutions/nnlsmag/>

This Novell web site provides the latest implementation guidelines and suggestions from Novell and the NNLS community.

## Agenda

This is a 5-day course.

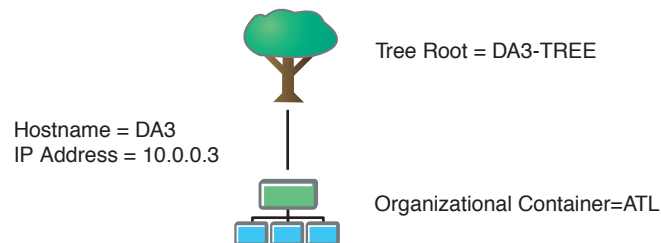
**Table Intro-1**

	<b>Section</b>	<b>Duration</b>
Day 1	<b>Introduction</b>	00:10
	<b>Section 1:</b> Explore the Linux Environment	02:00
	<b>Section 2:</b> Install and Upgrade Novell Nterprise Linux Services	02:00
	<b>Section 3:</b> Provide Directory Services with eDirectory	02:30
Day 2	<b>Section 4:</b> Manage User Identities with NNLS	03:00
	<b>Section 5:</b> Synchronize User Identities with NNLS	03:30
Day 3	<b>Section 6:</b> Provide Personal File Management Services with NNLS	03:00
	<b>Section 7:</b> Manage Printers with NNLS	03:00
Day 4	<b>Section 8:</b> Provide Web Mail Access with NNLS	03:00
	<b>Section 9:</b> Unify NNLS Web Access with Virtual Office	03:00
Day 5	<b>Section 10:</b> Prepare for the Novell CLE Practicum	06:00

## eDirectory Tree and Server

During NNLS installation, you install an eDirectory tree (DAx-TREE) with an organizational container (such as ATL) as illustrated in the following:

Figure Intro-1



The tree name reflects the hostname of the Linux server (such as DA3). The organizational container stores objects installed with NNLS and other objects you create or import during the course.

## Exercise Conventions

Students often become confused in class about where an exercise begins and ends.

Take a moment to show students one or more exercise headings in the manual.

Also point out the “end of exercise” paragraph tag that ends an exercise.

At the beginning of class, you are assigned an IP address and hostname for your Linux server. When installing eDirectory, you are also assigned an eDirectory tree name (such as DA3-TREE) and an organizational container name for the tree (such as BOI).

The organizational container name represents the Digital Airlines office for which you are employed as the network administrator.

When working through an exercise, you will see conventions that indicate information you need to enter that is specific to your server and eDirectory.

The following describes the most common conventions:

- **Your container.** This is the eDirectory organizational container that you have been assigned.

For example, if your container is DEL and you are supposed to enter

**is.your container.da**

you would enter

**is.del.da**

- **10.0.0.x**. This is the IP address that is assigned to your Linux server.

For example, if your IP address is 10.0.0.3, and you are supposed to enter

**10.0.0.x**

you would enter

**10.0.0.3**

- **DAx**. This the hostname (server name) of your Linux server.

For example, if your server name is DA3 and you are supposed to enter

**DAx**

you would enter

**DA3**



## SECTION 1 Explore the Linux Environment

In this section you review the Linux® knowledge and skills necessary to successfully complete this course.

### Objectives

1. Describe the Characteristics of Linux
2. Use the Linux Command Line Interface
3. Manage the Linux File System
4. Manage Linux Applications
5. Manage Linux Network Interfaces

## Objective 1      Describe the Characteristics of Linux

Inform students that NNLS requires a clean Linux installation. If they alter their Linux configuration beyond that which is specified in this course, they can experience problems with NNLS.

In this objective, you are introduced to the following:

- A Brief History of Linux
- The Role of Linux
- Working with Linux Distributions
- Working with the Linux File System

### ***A Brief History of Linux***

Linux is an operating system that is similar to UNIX®. Linux was first developed by Linus Torvalds in the early 1990s while he was a student at the University of Helsinki in Finland.

Torvalds studied an existing freeware version of UNIX called Minix and used this knowledge to develop a new operating system he dubbed “Linux.” Linux version 1.0 was released in 1994.

Linux is developed under the General Public License (GPL). This license ensures that the source code for Linux is freely distributable. Unlike other operating systems, developers are allowed to modify the Linux source code and recompile it to suit their needs.

Linux is Open Source software. In 1984, Richard Stallman of the Massachusetts Institute of Technology founded the GNU’s Not UNIX (GNU) project and the Free Software Foundation (FSF) to promote Open Source software.

The goal of the Open Source movement is to promote freely available software source code, allowing users to run, copy, modify, and distribute software.



## *The Role of Linux*

As with other operating systems, the role of Linux in a system includes the following:

- Providing a platform for applications to run on
- Managing and storing files in the file system
- Controlling user access to applications and files
- Providing application access to system hardware, such as the CPU, RAM, storage, and communication ports

Many network administrators use the Linux command-line interface (CLI), as shown in the following:

**Figure 1-1**

```
student@DA3:~$ su -
Password:
DA3:~ # cd /var/opt/novell
DA3:/var/opt/novell # ls
.  eGuide  iManager  ifolderdata  log  netmail  novlsw  samba  tomcat4
.. httpd  ifolder  iprint      naudit  netstorage  run  spool  xtier
DA3:/var/opt/novell #
```

The administrator communicates with the operating system by entering commands at the command prompt (also called a shell prompt).

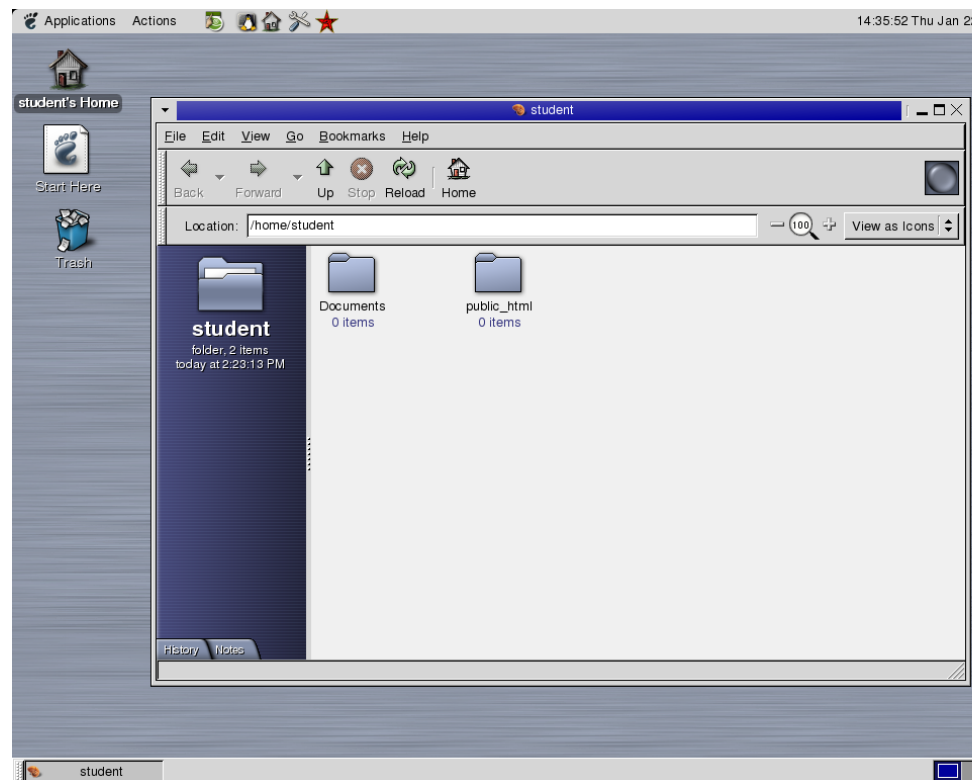
To make the Linux CLI easier to use with a graphical user interface (GUI), the XFree86 Project created a version of the UNIX X Window system that runs on Linux. This product is called XFree86™.

XFree86 provides a base X Windowing system. It is designed to let you choose a window manager that suits your preferences and tastes. Some popular window managers include

- Ximian®
- GNOME
- KDE

The GNOME window manager is shown in the following:

**Figure 1-2**



As with other operating systems using a window metaphor, you communicate with the operating system by double-clicking on icon-style shortcuts.

### ***Working with Linux Distributions***

When Linus Torvalds developed Linux in the early 1990's, he only produced the Linux kernel and a few utilities to manage it.

Because Linux is distributed under the GPL license, other developers have created their own utilities and applications that run on the kernel. Essentially, they create what is called a *distribution*.

Many companies (including Novell) develop their own Linux distributions. At latest count, over 160 English-language Linux distributions are available.

Some of the more popular Linux distributions include

- SuSE® Linux (from Novell®)
- RedHat® Linux
- Mandrake™ Linux
- TurboLinux
- Slackware Linux
- Debian GNU Linux
- Gentoo Linux
- CollegeLinux

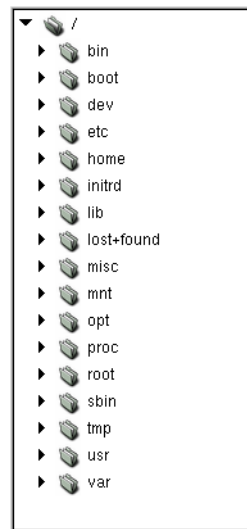
To view a full list of all distributions currently available, visit <http://www.linux.org/dist/>.

## ***Working with the Linux File System***

One of the key roles performed by the Linux operating system is providing storage services through creating and managing a file system.

The Linux file system is hierarchical, much like other operating systems you might have used. The root of the file system is named `/`, as shown in the figure below.

**Figure 1-3**



Directories below `/` are referenced from the root. For example, if you have a directory named `bin` that is located in a directory named `usr` that is located right below the root directory, it would be referenced as `/usr/bin`.

## Using Mount Points

The Linux file system uses the concept of *mount points*. Instead of using separate drive letters to represent different partitions in the file system, as operating systems such as MS-DOS® and Windows® 9x do, Linux mounts these partitions in a folder in the file system.

For example, if you were to add a new hard disk drive to a Linux system, first you would partition and format the drive. Then, you could make a directory, such as `/mnt/files`, in the file system and mount the drive in that directory. This is done using the *mount* command, discussed later.



---

You can also mount remote file systems, shared via the Network File System (NFS), to directories you create in your file system.

---

Removable drives, such as floppy disks and CDs, are mounted in this same manner. The following are examples of mounting removable devices:

- **SUSE**

A CD-ROM on `/dev/cdrom` is mounted to **`/media/cdrom`**.

A floppy on `/dev/floppy` is mounted to **`/media/floppy`**.

- **Red Hat**

A CD-ROM on `/dev/cdrom` is mounted to **`/mnt/cdrom`**.

A floppy on `/dev/floppy` is mounted to **`/mnt/floppy`**.

These defaults can be overridden on the command line with the *mount* command. The default assignments on any distribution are pre-defined in the `/etc/fstab` file.

Notice that SUSE does not use the `/mnt` directory as parent directory to mount removable devices. In this case, `/mnt` is only used for local and remote file systems and all removable devices are mounted to `/media`.

When you insert a floppy disk or a CD in a Linux system, you must mount it. Once done, you can access the content on the disk by changing to the directory in the file system where you mounted it.



Some Linux distributions use an automount function by default. Whenever you insert a CD or floppy, that device is automatically mounted to the default directory in your file system using a daemon process and information in the `/etc/fstab` file.

## Working with Linux Partitions

Linux partitions use file system types that are very different from those used by Microsoft operating systems. Some popular file system types used by Linux distributions are ReiserFS (SuSE) or EXT2 and EXT3 (Red Hat).

Older distributions use the EXT2 file system while newer distributions use the EXT3 or ReiserFS file systems. EXT3 and ReiserFS use journaling to speed disk recovery when the system is improperly shut down.

For example, a default Red Hat Linux installation will usually use 3 partitions, as shown in the following:

Figure 1-4

```
[root@S1 root]# fdisk /dev/sda
Command (m for help): p
Disk /dev/sda: 255 heads, 63 sectors, 522 cylinders
Units = cylinders of 16065 * 512 bytes

   Device Boot      Start         End      Blocks    Id System
/dev/sda1   *           1           6       48163+    83  Linux
/dev/sda2             7          490     3887730    83  Linux
/dev/sda3          491          522      257040     82  Linux swap
Command (m for help): _
```

These partitions are mounted in the file system as follows:

- **/boot.** This is an EXT3 partition that must reside within the first 1024 cylinders of a hard drive. It's usually about 50 MB in size and contains Linux boot up files.
- **/.** This is an EXT3 partition that can reside beyond the first 1024 cylinders of the hard drive. It contains Linux system files, user files, and application files.
- **SWAP.** This is a Linux Swap partition. Unlike Microsoft Windows®, which uses a swap *file*, Linux uses a dedicated swap *partition*. This partition should be at least as large as the total size of the installed system RAM.

### Working with Linux Boot Loaders

A *boot loader* is a small piece of software that is used to load an operating system from the file system. It resides in the boot sector of the first hard disk drive in the PC system.

After running the Power-On Self Test (POST), the PC BIOS searches the boot sector for a boot loader. If it finds one, it turns control of the boot process over to the boot loader.

The boot loader is configured with the location of the operating system files on the hard drive. The boot loader then either loads the default operating system or presents a menu allowing the user to select a specific operating system to be loaded.

The PC system can have more than 1 operating system installed. The boot loader can be used to select which operating system is to be used.

Linux boot loaders can be used to load Linux or other operating systems, such as Microsoft Windows. Windows NT®, 2000, or XP boot loaders can be used to load Linux as well.

The 2 Linux boot loaders most commonly used with most distributions are listed below:

- **Grand Unified Boot Loader (GRUB).** GRUB is used on many newer Linux distributions. To configure GRUB, you edit the /boot/grub/menu.lst file (Red Hat) or the /etc/grub.conf file (SuSE).

The /etc/grub.conf file is shown below:

Figure 1-5

```
#boot (hd0,0)
install --stage2=/boot/grub/stage2 /grub/stage1 d (hd0) /grub/stage2 0x8000 (hd0
,0)/grub/menu.lst
quit
~
~
~
~
~
```

Point out that after editing the lilo.conf file, you must run **lilo** before rebooting for the changes to take effect.

Figure 1-6

- **Linux Loader (LILO).** LILO was used on most earlier Linux distributions. To configure LILO, you edit the /etc/lilo.conf file, shown below.

```
install=/boot/boot.b
prompt
timeout=50
linear
default=linux

image=/boot/vmlinuz-2.2.14-5.0smp
label=linux
initrd=/boot/initrd-2.2.14-5.0smp.img
read-only
root=/dev/sda5

image=/boot/vmlinuz-2.2.14-5.0
label=linux-up
initrd=/boot/initrd-2.2.14-5.0.img
read-only
root=/dev/sda5
~
~
~
```

## Working with Linux Users

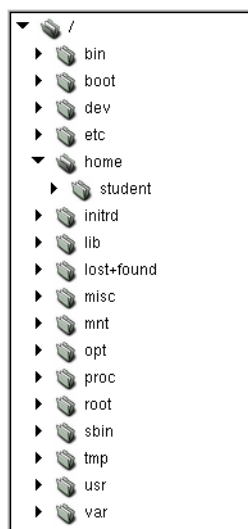
Linux is a multiuser operating system. Everyone who uses a Linux system should have his or her own user account. User accounts are used to control access to files and applications on the system.



During installation, Linux creates a default superuser account during installation named *root*. This account is used to administer the system. You should avoid using the root account when using the Linux system for day-to-day tasks.

Every user in the system has his or her own directory in the */home* directory in the file system, as shown in the following:

**Figure 1-7**



The exception to this rule is the root account. It has its own home directory in */root*.



Managing Linux users is covered in greater depth later in this section.

## Objective 2      Use the Linux Command Line Interface

As mentioned previously, Linux is essentially a command-line operating system. While the graphical X Windows interface makes Linux easier to use, many tasks still have to be performed from a command prompt. This is particularly true of administrative tasks.

In this objective, you learn the following:

- Using the Linux Shell
- Running Commands

### *Using the Linux Shell*

You will frequently hear the Linux command-line interface referred to as a *shell*. Essentially, the shell is the program that provides you with the command-line interface to the Linux system.

As with the graphical X Windows interface, you can select, based on your preferences, a number of different shells to use with your Linux system. Some of the more popular Linux shells include:

- **bash:** Bourne-Again Shell
- **zsh:** Z Shell
- **tsch:** tsch Shell
- **sh:** BourneShell
- **csh:** C Shell

To use a given shell, enter its command at the shell prompt. For example, to run the BourneShell, enter **sh**.

If you are running Linux without X Windows, you can use multiple shell consoles at the same time. This is very useful if you're waiting for a long-running program to complete and wish to run other programs.

To switch between consoles, press **Alt+function\_key**. For example, if you want to switch to the second console screen, press **Alt+F2**. Notice that you will have to log in a second time to have access to the command-line interface in the second console.

If you're running X Windows, you can press **Ctrl+Alt+function\_key** to switch to text-based terminal session. You can also simply open multiple terminal sessions to accomplish a similar result.

To switch back from the from a text-based terminal session to your X Windows system, press **Alt+F7**.

### ***Running Commands***

As with other operating systems, such as UNIX® and DOS, you can run Linux programs from the command line. To do this, you simply enter the name of the application or utility at the shell prompt.

However, there are 2 issues to keep in mind:

- Linux filenames and commands are case-sensitive. For example, **date** and **DATE** are not the same command. As well, a file named **Mythoughts.txt** is not the same file as one named **mythoughts.txt**.
- Linux uses a path variable, as do other operating systems. If you're familiar with DOS, you know that when a command is entered, the operating system first searches the current directory for the file. If it's not found, it then searches each directory contained in the PATH variable.

Linux, on the other hand, searches *only* the directories in the PATH variable, shown below.

Figure 1-8

```
student@DA3:~$ su -
Password:
DA3:~$ # echo $PATH
/sbin:/usr/sbin:/usr/local/sbin:/root/bin:/usr/local/bin:/usr/bin:/usr/X11R6/bin
:/bin:/usr/games:/opt/gnome2/bin:/opt/gnome/bin:/opt/kde3/bin:/usr/lib/java/jre/
bin:/opt/gnome/bin
DA3:~$ #
```

If you switch to the directory where an executable resides and try to run it, it won't be found if its directory isn't in the PATH variable. In this case, you must specify that the file resides in the current directory by adding `./` to the front of the command.

Commonly used Linux commands and utilities include the following:

- **init 0.** This command causes the system to shut down. It can only be run by the root user.
- **halt.** This command also causes the system to shut down.
- **init 6.** This command causes the system to shut down and reboot. It can only be run by the root user.
- **reboot.** This command causes the system to shut down and reboot.
- **man command.** This command will display the man page containing help and documentation for the command specified. For example, to get help with the `cp` command, you would enter **man cp**.
- **info command.** This command also displays a help page for the command specified. However, the information is more detailed than that displayed by the `man` command.
- **top.** This command will display a list of all running processes. This utility can be used to kill a misbehaving process.

If you enter **su *username***, it will allow you to log in as that user. If you don't supply a username, the system assumes you want to log in as root. If you enter **su -**, you will be able to log in as root and the system will use root's default environment variables.

- **netstat.** This command is used to display network connections, routing tables, interface statistics, and multicast memberships.
- **ifconfig.** This command is similar to the IPCONFIG command used with Windows. It is used to view and configure a network interface.
- **route.** This command can be used to view or modify the Linux server's IP routing table.
- **which.** This command can be used to display a shell command's location in the file system. For example, if you need to know where the ifconfig executable is located, you could enter **which ifconfig**.
- **env.** This command displays the current environment variables and their values.
- **su.** This command can be used to change to a different user in the system. It is frequently used to change to the root user account. Used with the - option, the environment variables of the other user are applied.  
  
For example, if you need to switch to the root (super user) account and load the appropriate environment variables, you would enter **su -**.

- **setup.** This command is specific to Red Hat Linux. It is used to configure various operating system components, including
  - Authentication
  - Firewall
  - Keyboard
  - Mouse
  - Network
  - Printer
  - System services
  - Sound cards
  - Timezone
  - X Windows
- **startx.** If you've configured your Linux system to boot to a command prompt, you can start the graphical X Windows environment with this command.

To learn how to use any of these utilities, enter **man *command*** at the shell prompt.

Many other useful Linux utilities are available. Some are presented later in this section when discussing file systems and user management. However, this course cannot cover them all.

**10 Minutes****Exercise 1-1 Working with the Linux Command Line**

The student Linux servers should be off before starting this exercise.

This exercise is intended to be an exploratory exercise. Students should refer to the preceding objective to determine the correct response to the questions. Provide coaching and feedback as required.

Students should use **su -** or **sux -**.

Students should enter **which netstat**.

Students should use the **env** or **env | more** command.

Students can use **env** or just look at the command prompt.

In this exercise, you practice working with the Linux command-line interface.

1. Turn on your Linux server.  
The server begins loading components. After a few minutes, you see the X Windows login screen.
2. Log in as **student** with a password of **novell** (make sure your session type is **gnome**).
3. Open a terminal session by selecting the **Terminal** icon at the top of your desktop (top panel).
4. Identify the shell version you're using by entering **echo \$SHELL** at the shell prompt. Which shell are you using?
5. How can you change to the root or super user account and ensure root's environment variables are available?
6. Where in the file system does the netstat utility reside?
7. Where is the currently logged-in user's home directory?
8. What is the username of the currently logged-in user?

Students should enter **ifconfig**.  
Students must change to the root account with **su** - or before they can run this command.

Students should use the **man route** command to identify the correct syntax.

Students should press **q**.

Students should use the **init 6** or the **reboot** command.

9. What is the MAC address assigned to your server's NIC?

10. What switches must be used with the route command to add a static route?

11. How do you exit a man page when you're done with it?

12. Reboot the server from the command line; then log in as **student** with a password of **novell** (make sure your session type is **gnome**).

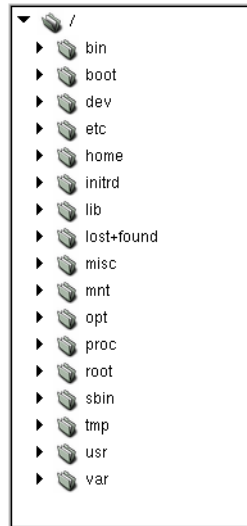
*(End of Exercise)*



## Objective 3    Manage the Linux File System

As mentioned previously, Linux organizes its file system using a hierarchical tree structure, as shown in the figure below.

**Figure 1-9**



In this objective, you learn about the following:

- Default Linux Directories
- Using Common File System Utilities
- Mounting CDs or Floppies
- Working with Archive Files
- Working with File System Security
- Editing Text Files

## ***Default Linux Directories***

The directories used in a Linux system are defined by the File System Hierarchy standard in the Linux Standards Base.

Some of the important default Linux directories include the following:

- **/etc.** This directory contains configuration files.
- **/dev.** This directory contains special link files that reference hardware in the system. For example, /dev/fd0 references floppy disk A. The first IDE hard disk is referenced by /dev/hda.  
  
It also contains special links for removable devices. For example, the CD-ROM drive is referenced by /dev/cdrom; /dev/fd0 (floppy drive) is linked to dev/floppy.
- **/usr.** This directory contains program files.
- **/var.** This directory contains data such as spool directories, log files, man pages, and other temporary files.
- **/tmp.** This directory stores temporary files created by running applications.
- **/home.** This directory contains user home directories.
- **/root.** This is the root user's home directory.
- **/bin.** This directory contains essential command-line utilities such as vi, rpm, ls, mkdir, more, mv, grep, and tar.
- **/sbin.** This directory contains essential system executables such as fsck, grub, mkfs, arp, fdisk, and ifconfig.
- **/mnt.** This directory is used to mount devices or remote file systems using Samba or NFS. On some Linux distributions (such as Red Hat) it is also used to mount removable devices.
- **/media.** This directory is used to mount removable devices on some Linux distributions (such as SuSE).

### *Using Common File System Utilities*

Common commands for managing the Linux file system include the following:

- **cp.** This command copies files.
- **mv.** This command can be used to move a file or rename a file.
- **rm.** This command deletes a file.
- **cd.** This command changes the current directory in the file system.
- **ls.** This command lists the files and subdirectories within the current directory. To see ownership and permissions assigned to files and directories, use **ls** with the **-l** switch.
- **dir.** This command also lists the files and subdirectories within the current directory. To see ownership and permissions assigned to files and directories, use **dir** with the **-o** switch.
- **pwd.** This command prints the current directory.
- **mkdir.** This command makes a directory.
- **rmdir.** This command deletes a directory.
- **more.** This command can be used to pause screen display 1 screen at a time.
- **less.** This command is similar to more; however, it allows you to move either forward or backward through the display.
- **grep.** This command can be used to search for a specific string of text within a file. To do this, enter **grep pattern filename**.

The grep utility provides many options as well as some derivatives (such as **fgrep** or **egrep**). The most useful command line option is **-i** which forces grep to ignore uppercase and lowercase letters in the pattern you specify.

- **find.** This command can be used to search for a file in the file system.

- **locate**. This command also searches for files in the file system, but uses a database and is much faster than **find**.

To build or rebuild the database for **locate**, **updatedb** is added to **cron.daily** to be executed daily in the background.

- **cat**. This command prints the content of a file to the screen.
- **tail**. This command prints the last 10 lines of a file to the screen. With the **-f** option, **tail** works in a forward mode scanning for additions to the specified file.

For example, a useful tool for monitoring log files (such as **syslog**) while troubleshooting a server problem is to use the **tail -f /var/log/messages** command.

### ***Mounting CDs or Floppies***

Unlike Windows or DOS, floppies or CDs are not immediately usable when they are inserted in a Linux system. They must first be mounted into the file system.

This is done using the **mount** command. The **mount** command uses the following syntax:

**mount -t filesystem\_type device\_file mount\_point**

The **-t** parameter allows you to specify the type of file system used on the media being mounted.

For example, a CD is mounted using the **iso9660** file system type. A FAT formatted floppy disk is mounted using the **vfat** file system type. A hard disk used in a Windows XP system would be mounted using the **ntfs** file system.

As mentioned earlier, the default parent directory for removable devices is different on different Linux distributions.

In this example, we're assuming Windows XP was installed to an NTFS partition. Point students to the **mount** man page for a complete list of supported file system types.

For example, to mount a floppy diskette in drive A, enter the following:

- **mount -t vfat /dev/fd0 /media/floppy** on distributions such as SuSE
- **mount -t vfat /dev/fd0 /mnt/floppy** on distributions such as Red Hat

With an appropriate entry in /etc/fstab, you can use the following shortcut on any distribution:

- **mount /dev/floppy**



---

On PC systems such as notebooks, the link **/dev/floppy** will not be created during installation if there was no floppy drive attached to the notebook. In this case you can create that link with **ln -s /dev/fd0 /dev/floppy**.

---

To mount a CD, enter the following:

- **mount -t iso9660 /dev/cdrom /media/floppy** on distributions such as SuSE
- **mount -t iso9660 /dev/cdrom /mnt/floppy** on distributions such as Red Hat

With an appropriate entry in /etc/fstab, you can use the following shortcut on any distribution:

- **mount /dev/cdrom**



---

On PC systems such as notebooks, the link **/dev/cdrom** will not be created during installation if there was no cdrom drive attached to the notebook. In this case you can create that link depending on your hardware.

For example, a CD-ROM drive attached on the second IDE channel can be linked with **ln -s /dev/hdc /dev/cdrom**.

---

Be sure students don't confuse the *umount* command with *unmount*.

After the device is mounted, you can access the removable media by changing to the directory in the file system where the device is mounted. For example, you could access a CD from a shell prompt on a SuSE distribution by entering **cd /media/cdrom**.

Before removing a floppy or a CD, you must first unmount it. Changes made to files on a floppy are not always written immediately to disk. When you unmount the diskette, all cached changes are written out to disk.

Unmounting is done with the **umount** command. You can either unmount the mount point (such as **umount /media/cdrom**) or the device name (such as **umount /dev/cdrom**).

Because /dev is standard directory on all Linux distributions, you can use a command such as **umount /dev/cdrom** to unmount a CD on all Linux distributions.

### ***Working with Archive Files***

Linux uses the concept of archive files. Archive files are similar to zip files used with other operating systems. However, with Linux, 2 separate utilities are used:

- **tar.** The tar utility is an archiving program that stores files to and extracts files from a single archive file (called a *tarfile*). Unlike zip files used with Windows and DOS, tarfiles are not compressed.
- **gzip and gunzip.** These utilities are used to compress (gzip) and decompress (gunzip) Linux files such as a tarfile.

You can identify a tarfile that has been compressed with gzip by noting the last 2 extensions in the archive file name. By convention, these files are given a *.tar.gz* extension and are called *tarballs*.

To unzip an tarball file, enter **gunzip filename**; then enter **tar -xvf filename**. The **-x** switch instructs tar to extract the archive, the **-v** switch instructs tar to extract the contents of the archive verbosely, and the **-f** switch instructs tar which file is to be processed.

Alternatively, you can use the **-z** switch with the tar command to automatically decompress the zip file before untarring the file, eliminating the need to first unzip it with gunzip. To do this, enter **tar -zxvf filename**.

**15 Minutes**

### **Exercise 1-2    Working with File System Commands**

In this exercise you work with file system commands.

Do the following:

1. Make sure you are logged in as **student** with a password of **novell**.
2. Open a terminal session and change to the root account by entering **su -** with a password of **novell**.
3. Identify failures listed in the system log file (/var/log/messages):
  - a. Switch to the /var/log directory by entering **cd /var/log**.
  - b. Locate occurrences of *failed* in the log file by entering **grep -i failed messages**.

The **grep** command should return a list of entries from the log file containing the text string *failed* (uppercase or lowercase).
4. View the latest entries in the system log file (/var/log/messages):
  - a. At the shell prompt, enter **tail messages**.
  - b. Note the log entries for your server.
5. Generate a rolling log for your system messages:
  - a. At the shell prompt, enter **tail -f messages**.

The **-f** option appends data to the messages file displayed in your terminal session window.
  - b. Note the existing system messages on your screen, and then switch to a terminal session prompt by pressing **Ctrl+Alt+F2**.
  - c. Login as **root** (with a **novell** password) to that terminal.
  - d. Switch back to your X Windows system by pressing **Alt+F7**.
  - e. Review the new system messages in your terminal session window.



- f. Close the rolling log and return to a shell prompt by pressing **Ctrl+C**.

6. Mount a CD:

- a. Insert your *3015 Course CD* into your server's CD drive.
- b. Mount the CD by entering the following:

**mount /dev/cdrom**

If this command does not mount the CD, try entering the complete command:

**mount -t iso9660 /dev/cdrom /media/cdrom**



---

You might want to modify the `/etc/fstab` to allow using **mount /media/cdrom** or **mount /dev/cdrom** at a shell prompt.

---

7. View the contents of the CD:

- a. At the shell prompt, enter **cd /media/cdrom**.
- b. List the contents (directories and files) of the CD by entering **ls**.
- c. List details of the CD contents by entering **ls -l**.

8. Create a new directory named `myStuff` in `/tmp` by entering **mkdir /tmp/myStuff**.

9. Copy a file (such as `readme.txt`) from the CD to `/tmp/myStuff`:

- a. Identify a file you want to copy.
- b. At the command prompt, enter the following:

**cp filename /tmp/myStuff**.

10. Delete the file you just created by entering **rm /tmp/myStuff/filename**.

11. Delete the directory you created by entering **rmdir /tmp/myStuff**.

12. (Conditional) If asked to confirm the deletion, enter **y**.

**13. Unmount the CD:**

- a. At the shell prompt, enter **cd /**.

If the current directory is set to a directory on a mounted CD or floppy, you cannot unmount it.

- b. At the shell prompt, enter **umount /media/cdrom**.
- c. Remove the CD from the drive.

**14. Close the root session by entering **exit**.****15. Close the terminal session window.**

*(End of Exercise)*

### ***Working with File System Security***

As with other operating systems, you control access to files in the file system by using the following elements:

- **Users.** Users are individual accounts on the Linux system.
- **Groups.** Groups are collections of users. Users are assigned to a group when they are created. Only root or the owner can change the group to which the file or directory is assigned. Every user must belong to at least 1 group.
- **Permissions.** Permissions determine user access to a file or directory.
- **Ownership.** The user who creates a file or directory is automatically assigned as its owner. Ownership can only be changed manually by root.

The password field in the passwd file is not used in current distributions. It is kept for backwards compatibility.

The Linux system stores all user and group information in 3 files:

- **/etc/passwd.** This file stores user information. Each line in the file is a user record. The record is composed of seven fields separated by a **:**. These fields are
  - Login Name
  - Password
  - User ID
  - Group ID
  - Full Name
  - Home Directory
  - Shell

A sample passwd file is shown below:

**Figure 1-10**

```
DAB3:" # more /etc/passwd
root:x:0:0:root:/root:/bin/bash
bin:x:1:1:bin:/bin:/bin/bash
daemon:x:2:2:Daemon:/sbin:/bin/bash
lp:x:4:7:Printing daemon:/var/spool/lpd:/bin/bash
mail:x:8:12:Mailer daemon:/var/spool/clientmqueue:/bin/false
games:x:12:100:Games account:/var/games:/bin/bash
wwwrun:x:30:65534:WWW daemon apache:/var/lib/wwwrun:/bin/bash
named:x:44:44:Nameserver daemon:/var/named:/bin/bash
nobody:x:65534:65533:nobody:/var/lib/nobody:/bin/bash
ftp:x:40:49:FTP account:/srv/ftp:/bin/bash
man:x:13:62:Manual pages viewer:/var/cache/man:/bin/bash
news:x:9:13:News system:/etc/news:/bin/bash
uucp:x:10:14:Unix-to-Unix CoPy system:/etc/uucp:/bin/bash
at:x:25:25:Batch jobs daemon:/var/spool/atjobs:/bin/bash
irc:x:39:65534:IRC daemon:/usr/lib/ircd:/bin/bash
sshd:x:71:65:SSH daemon:/var/lib/ssh:/bin/false
postfix:x:51:51:Postfix Daemon:/var/spool/postfix:/bin/false
postgres:x:26:26:PostgreSQL Server:/var/lib/pgsql:/bin/bash
snort:x:73:68:Snort network monitor:/var/lib/snort:/bin/bash
squid:x:31:65534:WWW-proxy squid:/var/cache/squid:/bin/false
ntp:x:74:65534:NTP daemon:/var/lib/ntp:/bin/false
hacluster:x:90:90:heartbeat processes:/var/lib/heartbeat:/bin/bash
```

- **/etc/shadow.** This file stores encrypted user passwords and password expiration information. Most Linux systems use *shadow passwords*. Shadow passwords are stored in */etc/shadow* instead of */etc/passwd*.

Each line in the /etc/shadow file represents 1 password. Each record contains 9 fields separated by a :. These are

- ❑ Login Name
- ❑ Encrypted Password
- ❑ Last Change
- ❑ Min Days
- ❑ Max Days
- ❑ Warning
- ❑ Allow Inactive
- ❑ Expires
- ❑ Unused

A sample shadow file is shown below:

**Figure 1-11**

```
DA3:~ # more /etc/shadow
root:t7HvGRsvSVZAk:12432:0:10000:::
bin:!:8902:0:10000:::
daemon:!:8902:0:10000:::
lp:!:8902:0:10000:::
mail:!:8902:0:10000:::
news:!:8902:0:10000:::
uucp:!:8902:0:10000:::
games:!:8902:0:10000:::
man:!:8902:0:10000:::
wwwrun:!:8902:0:10000:::
ftp:!:8902:0:10000:::
named:!:8902:0:10000:::
nobody:!:8902:0:10000:::
at:!:12432:0:99999:7:::
irc:!:12432:0:99999:7:::
sshd:!:12432:0:99999:7:::
postfix:!:12432:0:99999:7:::
postgres:!:12432:0:99999:7:::
snort:!:12432:0:99999:7:::
squid:!:12432:0:99999:7:::
ntp:!:12432:0:99999:7:::
hacluster:!:12432:0:99999:7:::
```

- **/etc/group.** This file stores group information. Each line in the file represents a single group record. Each record is composed of 4 fields separated by a **:**. These include
  - Group Name
  - Password
  - GID (Group ID)
  - Members

A sample group file is shown below:

**Figure 1-12**

```
DA3:~ # more /etc/group
root:x:0:root
bin:x:1:daemon
daemon:x:2:
sys:x:3:
tty:x:5:
disk:x:6:
lp:x:7:
www:x:8:
kmem:x:9:
wheel:x:10:
mail:x:12:
news:x:13:
uucp:x:14:student
shadow:x:15:
dialout:x:16:student
audio:x:17:student
floppy:x:19:
cdrom:x:20:
console:x:21:
utmp:x:22:
public:x:32:
videt:x:33:student
```

Every file and directory in the file system is assigned access permissions. The permissions assigned determine the level of access a given user has. Permissions are assigned at 3 levels:

- **Owner.** The permissions assigned to a file or directory's owner determine the owner's level of access.
- **Group.** Permissions assigned to the group assigned to a file or directory determine the level of access users who are members of the group have to the file or directory.
- **Others.** Permissions assigned to this entity apply to authenticated users who are not members of the group that has been associated with the file or directory.

Three permissions that can be assigned to a file or directory are

- **Read.** This permission allows the file to be read or the contents of a directory to be listed.
- **Write.** This permission allows a file to be modified. It allows files to be created, modified, or deleted within a directory.
- **Execute.** This permission allows a file to be executed. It allows access to a directory.

Every file and directory in a Linux system has a numerical permission value assigned to it. This value is composed of 3 digits.

The first digit represents the permissions assigned to the file or directory owner. The second digit represents the permissions assigned to the group associated with the file or directory. The third digit represents the permissions assigned to others.

Each digit is the sum of 3 values assigned to the entity:

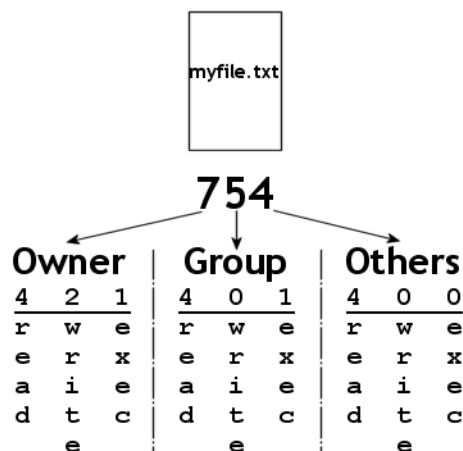
- Read: **4**
- Write: **2**
- Execute: **1**

For example, suppose a file named *myfile.txt* has 754 permissions assigned to it.

This means the *owner* of the file has read, write, and execute permissions (4+2+1), the *group* associated with the file has read and execute permissions (4+1), and *others* have read permissions (4).

This is shown in the following:

Figure 1-13



You can modify a file or directory's security in two ways. From the command line, you can use the following utilities:

- **ls -l.** This command displays the contents of the current directory with the assigned permissions.

The permissions for the `myfile.txt` example are shown in the following:

Figure 1-14

```

Owner  Group Others
[roo@RCE tmp]# ls -l
total 48
-rw-r--r-- 1 root  root    12304 Dec 12 03:44 instal
-rw-r--r-- 1 root  root      0 Dec 12 03:17 instal
-rwxr-xr-- 1 root  root      6 Dec 12 14:55 myfile
drwx----- 2 root  root    4096 Dec 12 03:32 orbit-
-rw-rw-rw- 1 apache apache    6 Dec 12 11:48 rcq-ru
-rw----- 1 apache apache   6255 Dec 12 11:53 sess_5
ef964966f8775
-rw----- 1 root  root      0 Dec 12 11:48 sessio
-rw----- 1 root  root      0 Dec 12 11:48 sessio
drwxr-xr-x 8 201   201    4096 Dec 12 10:51 vmware
[roo@RCE tmp]# _

```

- **chmod.** This command changes the permissions assigned to the file or directory.
- **chown.** This command changes the owner assigned to a file or directory.
- **chgrp.** This command changes the group assigned to a file or directory.



For specific details on the switches used with these commands, see each command's man page.

---

You can also modify a file or directory's security using the graphical user interface.

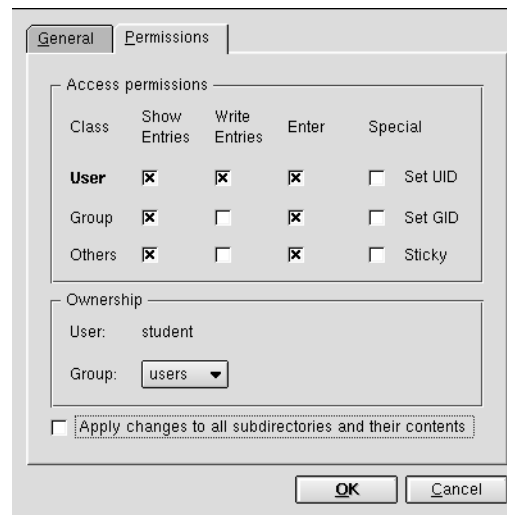
Do the following:

1. Browse to the **file** or **directory** using an X Window file manager utility.
2. Right-click the **file** or **directory** you want to modify; then select **Show Properties** or **Properties**.
3. Select **Permissions**.



A screen similar to the following appears.

**Figure 1-15**



4. Modify the *security* as desired; then close the window.

### ***Editing Text Files***

Most Linux configuration settings are managed by editing text files. By default, most of these files reside in the /etc directory. Most Linux distributions include a number of text editors, both graphical and command-line.

One of the most common text editors is Vi (or the modified version Vim). You can use Vi on any Unix or Linux system from a shell prompt.

Several graphical editors are also available from the X Windows interface. For example, you can use KWrite (SuSE) or gedit (Red Hat) to edit a file in a graphical text editor window.

To effectively administer Linux, you need to know the following:

- How to Edit Text Files with Vim
- How to Edit Text Files with gedit (Red Hat)
- How to Edit Text Files with KWrite (SuSE)

### How to Edit Text Files with Vim

Depending on the Linux distribution you are using, you might have *vim* or *vi* installed.

Figure 1-16

If you need to edit a text file with from the command-line, you can use the Vim utility. To use Vim, enter **vim** or **vi** at the command prompt. The following appears:



```

VIM - Vi IMproved
      version 6.1.150
    by Bram Moolenaar et al.
Vim is open source and freely distributable

  Help poor children in Uganda!
type :help iccf<Enter>      for information

type :q<Enter>              to exit
type :help<Enter> or <F1>   for on-line help
type :help version6<Enter> for version info

                                0,0-1      All
  
```

Demonstrate how to use Vim.

To open a file for editing in Vim, enter **vi** */path\_to\_file/file\_name*.

Vim has 2 main modes: *Command mode* and *Insert mode*. Command mode lets you enter commands to manipulate the text. Insert mode lets you edit the text.

Vim starts, by default, in Command mode. To enter Insert mode, press **Ins** or **i**. To return to Command mode, press **Esc**.

To enter most commands in Vim, enter Command mode by pressing **Esc**, type **:**, and then enter the command.

For example, to exit Vim and save the changes to the text file that is open in the editor, you would enter **:exit** or **:q**. To exit Vim without saving changes to the file that is currently open, you would enter **:quit!** or **:q!**.



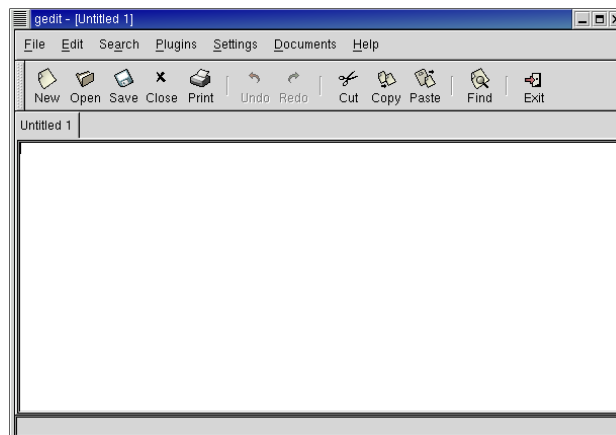
To learn more about using Vim, enter **vimtutor** at a shell prompt.

### How to Edit Text Files with gedit (Red Hat)

While working in a graphical environment, you can use gedit to edit files. This utility is very similar to those used in other operating systems such as Windows.

From within the GNOME window manager, you run gedit by selecting **Main Menu (foot icon) > Programs > Applications > gedit**. The following appears.

Figure 1-17

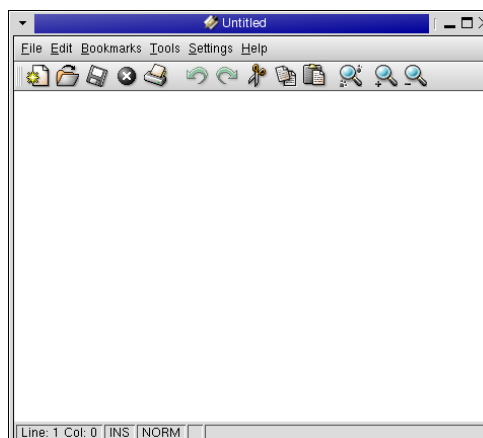


### How to Edit Text Files with KWrite (SuSE)

While working in a graphical environment, you can use KWrite to edit files. This utility is very similar to those used in other operating systems such as Windows.

From within the GNOME window manager, you run KWrite by selecting **Main Menu (foot icon) > KDE Menu > Editors > KWrite**. The following appears.

**Figure 1-18**



**15 minutes**

### ***Exercise 1-3 Edit Text Files and Manage Permissions***

In this exercise, you create a new text file; then you make it into an executable script.

Do the following:

1. Make sure you are logged in as **student** with a password of **novell**.
2. Open a terminal session.
3. Change to the root account by entering **su -** and a password of **novell**.
4. Change to the /tmp directory by entering **cd /tmp**.
5. Create a new file called myfile.txt by entering **vi myfile.txt**.
6. Press **Ins**.
7. Enter the following lines of text in the file:

```
echo "Changing to /var/log."  
cd /var/log  
echo "Running grep to check for failures in the log file."  
grep -i failed messages  
cd /tmp  
echo "This script is now finished."
```

8. Press **Esc**.
9. Enter **:exit**.
10. View the contents of your file by entering **cat myfile.txt**.
11. Try running your file as a script by entering **./myfile.txt**. What happens?

Students should see a message that states "...Permission denied" because the file doesn't have the execute bit turned on.

The file owner should be root.

12. Verify who the owner of the file is by entering **ls -l**. Who owns the file?

The file should have read-write (owner), read (group), and read (other).

13. What permissions are assigned to your file?

The numerical equivalent of the permissions assigned to the file would be 644.

14. What would be the numerical value of the permissions assigned to your file?

The file should have read-write-execute (owner), read (group), and read (other).

15. Make the file executable by only the file owner by entering **chmod 744 myfile.txt**.

16. Check the new permissions assigned to the file by entering **ls -l**. What permissions have been assigned?

The file runs as a script and the commands contained within it are executed.

17. Try running your file as a script now by entering **./myfile.txt**. What happens?

18. Close the root session by entering **exit**.

19. Close the terminal session window.

***(End of Exercise)***

## Objective 4    **Manage Linux Applications**

As with other operating systems, Linux provides a platform for applications. You need to understand the following about managing applications:

- Installing Packages
- Starting and Stopping Services
- Managing Processes

### ***Installing Packages***

You can install applications on a Linux system in 3 different ways:

- Untarring an archive and using an installation script to copy and modify the appropriate files
- Using Red Hat Package Manager (RPM) to install an RPM file
- Using YaST on SuSE distributions to install files

This objective focuses on using the following:

- Red Hat Package Manager (RPM)
- YaST and RPM on SuSE

## Red Hat Package Manager (RPM)

Each Red Hat CD has a directory named RPMS, as shown in the following:

Figure 1-19

```

5.rpm
-rw-r--r--  5 root    root      145993 Jun 14  2002 XFree86-xdm-4.1.0-29.i386
5.rpm
-rw-r--r--  5 root    root      145050 Jun 14  2002 XFree86-xfs-4.1.0-29.i386
5.rpm
-rw-r--r-- 19 root    root      188756 Sep  5  2001 xinetd-2.3.3-1.i386.rpm
-rw-r--r-- 39 root    root      16403 Sep  7  2001 xinitrc-3.20-1.noarch.rpm
m
-rw-r--r--  9 root    root      31425 Apr 25  2002 xisdnload-1.38-47.i386.r
pm
-rw-r--r-- 22 root    root      128472 Sep  7  2001 xloadimage-4.1-21.i386.r
pm
-rw-r--r-- 16 root    root      1439139 Sep  7  2001 xmms-1.2.5-7.i386.rpm
-rw-r--r-- 16 root    root      23881 Sep  7  2001 xmms-gnome-1.2.5-7.i386.
rpm
-rw-r--r-- 12 root    root      914446 Jan  5  2002 xsane-0.82-3.1.i386.rpm
-rw-r--r-- 25 root    root      2984605 Sep  7  2001 xscreensaver-3.33-4.i386
.rpm
-rw-r--r-- 22 root    root      17318 Sep  7  2001 xsri-2.0.3-1.i386.rpm
-rw-r--r-- 16 root    root      28528 Sep  7  2001 ypbind-1.8-1.i386.rpm
-rw-r--r-- 16 root    root      128339 Sep  7  2001 ypserv-1.3.12-2.i386.rpm
-rw-r--r-- 19 root    root      53578 Sep  7  2001 yp-tools-2.5-1.i386.rpm
-rw-r--r-- 18 root    root      112972 Sep  7  2001 zip-2.3-10.i386.rpm
-rw-r--r-- 20 root    root      35342 Mar 10  2002 zlib-1.1.3-25.7.i386.rpm
[root@S1 RPMS]#

```

This directory contains a number of RPM packages that you can install on your Linux system.

You can use 2 utilities to install or uninstall an RPM package:

- **rpm:** A command-line RPM utility.
- **Gnome RPM:** An X Windows RPM utility.

To install an RPM package with rpm, you enter the following:

**rpm -i *package\_file\_name***

For a verbose display of what's happening during the installation, enter the following:

**rpm -ihv *package\_file\_name***

To uninstall an RPM package with rpm, you enter the following:

**rpm -e *package\_file\_name***



To install a package with Gnome RPM, you do the following:

1. From your Gnome desktop, select the **Start Here (foot icon) > Programs > System > GnoRPM**.
2. Select **Install**.
3. Browse to and select the *package* you want to install; then select **Install**.

### **YaST and RPM on SuSE**

On your SUSE distribution, you can use YaST to install files and applications by doing the following:

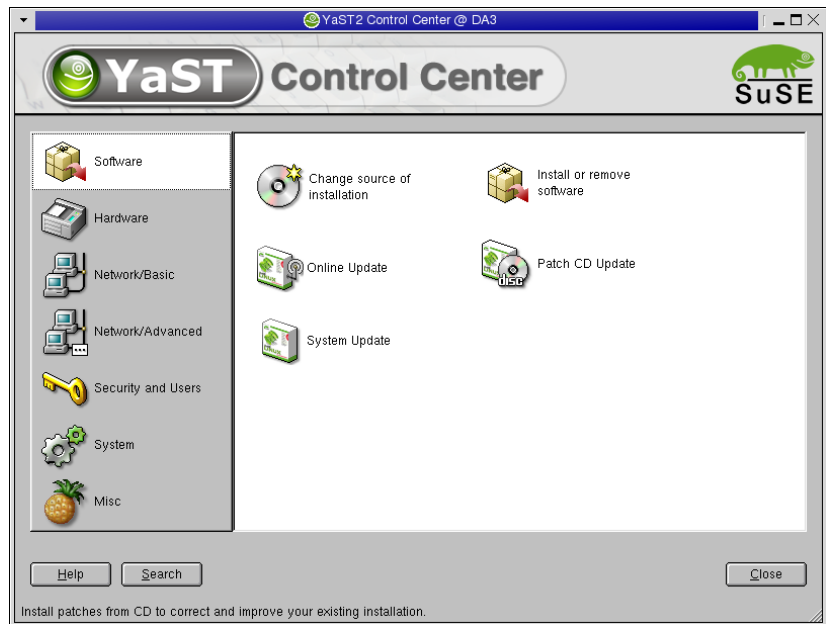
1. From the panel on your desktop, start YaST by selecting the **YaST** icon.

If you are not logged in as root, you are prompted for the root (super user) password.

2. (Conditional) Enter the root password.

The YaST Control Center appears:

Figure 1-20



3. Make sure Software is selected (on the left).
4. On the right, the most frequently used applications are the following:
  - ❑ **Install or remove software.** This application lets you install or remove packages prepared for the SUSE distribution.
  - ❑ **Online Update.** This application lets you keep your SUSE system up-to-date with all patches and fixed suggested by SUSE.
5. When you finish using these (and other software applications), close the YaST Control Center by selecting **Close**.

As with Red Hat distributions, you can also install an RPM package with rpm on SuSE by entering the following:

***rpm -i package\_file\_name***

For a verbose display of what's happening during the installation, enter the following:

***rpm -ihv package\_file\_name***

To uninstall an RPM package with rpm, you enter the following:

***rpm -e package\_file\_name***

### ***Starting and Stopping Services***

As with other operating systems, you can start, stop, and restart services on your Linux system while it is running. The scripts to do these tasks are located in the init daemon script directory.

On distributions such as SuSE, this directory is */etc/init.d*; on distributions such as Red Hat, this directory is */etc/rc.d/init.d*, often with a */etc/init.d* link pointing to the */etc/rc.d/init.d* directory.

The following lists the contents of a typical init.d directory:

Figure 1-21

```

bgpd          ipsec          ospfd          smpppd
boot          ipvsadm         pcsd           snmpd
boot,clock   ipxmount       pkcipe        snort
boot,crypto  ipxrip        pkcsslotd     splash
boot,d       ircd           portmap       splash_early
boot,evms    iscsi         postfix       splash_late
boot,idedna  isdn          postgresql    squid
boot,ipconfig joystick      powerfail     sshd
boot,isapnp  kbd           powertweakd   syslog
boot,klog    ksysguardd    pptpd         sysstat
boot,ldconfig ldirectord    quota         vtun
boot,local   lisa          quotad        wwwoffle
boot,localfs microcode      radvd         xdm
boot,localnet mon            random        xfs
boot,lvm     mrtcd         raw           xntpd
boot,mtd     nagios        rc            ypbind
boot,proc    named         rc0,d         yppasswdd
boot,quota   ndsd          rc1,d         ypserv
boot,restore_permissions ndssnmpsa    rc2,d         ypservd
boot,scpm    nessusd       rc3,d         z90crypt
boot,scsidev network       rc4,d         zebra
boot,swap    nfs           rc5,d
boot,sysctl  nfslock      rc6,d
DAG:~ # █

```

To start a service, change to the `/etc/rc.d/init.d` directory (Red Hat) or the `/etc/init.d` directory (SuSE) and enter `./service_name start`.

To stop a service, change to the `/etc/rc.d/init.d` directory (Red Hat) or the `/etc/init.d` directory (SuSE) and enter `./service_name stop`.

To stop and restart a service, change to the `/etc/rc.d/init.d` directory (Red Hat) or the `/etc/init.d` directory (SuSE) and enter `./service_name restart`.



Linux distributions also have shortcuts for starting and stopping services with referencing or changing to the init.d directory.

On distributions such as SuSE, you can use **rc** before the name of the service (such as **rcndsd start**); on distributions such as Red Hat, you can use **service** (such as **service ndsd start**).

Services can be configured to automatically start using the **chkconfig** utility. This command can be used to set runlevel information for system services.

A *runlevel* is a Linux configuration mode that specifies the types of services available. There are 6 runlevels available:

- **0:** System shut-down
- **1:** Single user with networking (only used for troubleshooting)
- **2:** Multi-user without most services available (not normally used)
- **3:** Multi-user with all services available but without X Windows running (used when you boot to a command prompt)
- **4:** Not implemented
- **5:** Multi-user with all services including XWindows (used when you boot to a graphical login screen)
- **6:** System reboot

Using `chkconfig`, you can specify whether or not a particular service is loaded at a given runlevel. The syntax for `chkconfig` is different on SuSE and Red Hat:

- **SuSE**

The following is the syntax for distributions such as SuSE:

**`chkconfig service_name levels`**

For example, **`chkconfig xntpd 235`** starts NTP in run levels 2, 3, and 5.

- **Red Hat**

The following is the syntax for distributions such as Red Hat:

**`chkconfig --levels service_name status`**

For example, **`chkconfig --235 xntpd on`** starts NTP in run levels 2, 3, and 5.

You can replace *status* with **on**, **off**, or **reset**.

## Managing Processes

You can view the currently running processes on your Linux system with the **top** utility:

Figure 1-22

```

10:38am up 19:50, 3 users, load average: 0.77, 0.71, 0.40
515 processes: 490 sleeping, 25 running, 0 zombie, 0 stopped
CPU states: 1.7% user, 8.6% system, 0.0% nice, 89.6% idle
Mem: 644560K av, 632736K used, 11824K free, 0K shrd, 190000K buff
Swap: 793792K av, 636K used, 793156K free

```

PID	USER	PRI	NI	SIZE	RSS	SHARE	STAT	%CPU	%MEM	TIME	COMMAND
12849	root	18	0	1216	1216	716	R	8.9	0.1	0:04	top
1	root	15	0	236	236	204	S	0.0	0.0	0:04	init
2	root	15	0	0	0	0	SW	0.0	0.0	0:00	keventd
3	root	34	19	0	0	0	SWN	0.0	0.0	0:00	ksoftirqd_CPU0
4	root	15	0	0	0	0	SW	0.0	0.0	0:00	ksuapd
5	root	25	0	0	0	0	SW	0.0	0.0	0:00	bdflush
6	root	15	0	0	0	0	SW	0.0	0.0	0:00	kupdated
7	root	16	0	0	0	0	SW	0.0	0.0	0:00	kinod
9	root	25	0	0	0	0	SW	0.0	0.0	0:00	mdrecoveryd
12	root	15	0	0	0	0	SW	0.0	0.0	0:00	kreiserfsd
69	root	0	-20	0	0	0	SW<	0.0	0.0	0:00	lvm-mpd
359	root	15	0	6568	6568	2588	S	0.0	1.0	0:06	rcd
386	root	15	0	600	600	492	S	0.0	0.0	0:00	syslogd
389	root	15	0	1452	1452	428	S	0.0	0.2	0:00	klogd
425	root	20	0	0	0	0	SW	0.0	0.0	0:00	khud
551	root	15	0	1528	1528	992	S	0.0	0.2	0:00	nmbd
552	root	15	0	1836	1836	1244	S	0.0	0.2	0:00	smbd

A graphical version is available (called System Monitor) with the GNOME window manager on some distributions (such as Red Hat):

Figure 1-23

GNOME System Monitor

File View Settings Windows Help

Processes (all) Memory Usage (resident) Filesystems (free)

CPU MEM SW LA

PID	User	Pri	Size	Resident	Stat	CPU	MEM	Time	Cmd
1893	root	14	26556	8124	S	3.3	6.4	6.56s	X
1	root	15	512	464	S	0.0	0.3	4.97s	init
377	root	15	512	492	S	0.0	0.3	2.95s	/usr/sbin/vmware-gue
5	root	15	0	0	SW	0.0	0.0	2.85s	ksuapd
2021	root	15	9304	9304	S	0.0	7.3	1.64s	nautilus
1962	root	15	5488	5488	S	0.0	4.3	1.38s	panel
1996	root	15	6828	6828	S	0.0	5.4	1.11s	hyperbola
2076	root	15	4676	4672	S	0.0	3.7	0.78s	gnorpm-auth
1926	root	15	3376	3376	S	0.0	2.6	0.64s	sawfish
2081	root	15	4344	4344	R	2.3	3.4	0.57s	gtop
1896	root	15	4076	4076	S	0.0	3.2	0.56s	/usr/bin/gnome-sessi
1990	root	15	5388	5388	R	0.0	4.2	0.56s	nautilus-throbber
17	root	15	0	0	SW	0.0	0.0	0.52s	kjournald
1812	root	15	2344	2344	S	0.0	1.8	0.48s	oaf

CPU: 1.99% user, 3.19% system | 7:58am, up 0:28 | loadavg: 0.67, 0.31, 0.25

You can run this application on Red Hat by selecting **Start Here (foot icon) > Programs > System > System Monitor**.

If you encounter a misbehaving or hung process, you can kill it using one of the following methods:

- To kill a process with top, press **k** and enter the **PID** of the process you want to kill.
- To kill a process with System Monitor, right-click the **process** and select **Kill nicely** or **Kill now**.
- To kill a process with the basic kill command, enter **kill options PID** (where PID represents the process you want to kill).

If you only know the name, but not the PID, of a process, you can use the **killall** command. For example to kill all httpd processes, you would enter **kill options httpd**.

**Exercise 1-4 Install Mozilla 1.5****15 Minutes**

This exercise is required for students to be able to successfully complete other exercises in the course.

iManager is an administrative tool for Novell Nterprise Linux Services 1.0 that runs from a web browser.

The version of Mozilla installed with SuSE SLES 8 does not support all the features of the iManager administration tool. You need to upgrade to Mozilla 1.5 or later.

To install Mozilla 1.5, do the following:

1. From your Linux server, insert the *3015 Course CD* in your server's CD drive.
2. Open a terminal session.
3. Change to the super user account by entering **sux -** and a password of **novell**.
4. Mount the 3015 Course CD by entering **mount /media/cdrom**.



For some CD-ROM drives, you might need to enter **mount -t iso9660 /dev/cdrom /media/cdrom**.

5. Change directories to /media/cdrom at the shell prompt by entering **cd /media/cdrom**.
6. At the shell prompt, copy the Mozilla 1.5 installation tarball to the /tmp directory by entering the following:  
**cp mozilla-i686-pc-linux-gnu-1.5-sea.tar.gz /tmp**
7. After the file is copied, enter **cd /**.
8. Umount the CD by entering **umount /media/cdrom**; then remove the CD from the drive.
9. Change directories to the /tmp directory by entering **cd /tmp**.



10. At the shell prompt, enter the following:

**tar -zxvf ./mozilla-i686-pc-linux-gnu-1.5-sea.tar.gz.**

This creates an installation file set in a directory named “mozilla-installer” in the /tmp directory.

11. Change to the new directory by entering the following:

**cd mozilla-installer**

12. Start the installation from the shell prompt by entering the following:

**./mozilla-installer**

13. Follow the prompts to install Mozilla (do a **Typical** installation and accept the creation of the **/usr/local/mozilla** directory).

The Mozilla browser window opens.

14. Close the browser window.

15. Exit the super user session by entering **exit**; then close the terminal session window.

16. Modify the Mozilla panel icon to launch Mozilla 1.5 by doing the following:

- a. Log out as student by selecting **Actions > Log Out**; then select **OK**.

You are returned to the graphical login screen.

- b. Select the **gnome** session type; then login as **root** with a password of **novell**.

- c. At the top of your desktop, right-click the Mozilla icon; then select **Properties**.

A Launcher Properties dialog appears.

- d. Make sure the **Basic** tab is selected; then enter the following:

□ Name: **Mozilla 1.5**

□ Command: **/usr/local/mozilla/mozilla**

- e. When you finish, select **Close**.

17. Test the Mozilla icon by selecting it.

The Mozilla 1.5 browser opens.

18. Close the browser window.

19. Log out as root by selecting **Actions > Log Out** and **Save current setup**; then select **OK**.

You are returned to the graphical login screen.

20. Log in as **student** with a password of **novell** (make sure the **gnome** session type is selected).

*(End of Exercise)*

## Objective 5      Manage Linux Network Interfaces

From time to time, you might need to change the network configuration settings for the network interfaces used by Linux.

Linux network interfaces for Ethernet are labeled *eth0*, *eth1*, *eth2*, etc. For PCI network adapters, the adapter with the lowest slot number is usually assigned to *eth0*. The next highest adapter is assigned *eth1*, and so on.

The localhost loopback interface (which is configured with an IP address of 127.0.0.1) is assigned to the *lo* interface. The *lo* interface is always configured, even if the PC doesn't have a network board physically installed.

You can configure Linux network interfaces in one of 2 ways:

- Configuring Network Interfaces from the Command Line
- Configuring Network Interfaces from Red Hat
- Configuring Network Interfaces from SuSE

### ***Configuring Network Interfaces from the Command Line***

To configure a Linux network interface from a command line, you use the *ifconfig* utility. The *ifconfig* utility uses the following syntax:

#### ***ifconfig interface options***

If you enter *ifconfig* without any arguments, it will return the current configuration of all the interfaces in the system. You must be logged in as root or have equivalent permissions to use *ifconfig*.

The output from ifconfig is shown below:

Figure 1-24

```
student@DA3:~$ su -
Password:
DA3:~$ # ifconfig
eth0      Link encap:Ethernet  HWaddr 00:02:B3:5C:69:F3
          inet addr:10.0.0.3  Bcast:10.255.255.255  Mask:255.0.0.0
          inet6 addr: fe80::202:b3ff:fe5c:69f3/10 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:8671 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1720 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:676382 (660.5 Kb)  TX bytes:244781 (239.0 Kb)
          Interrupt:10 Base address:0x1040 Memory:f3e00000-f3e00038

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:81935 errors:0 dropped:0 overruns:0 frame:0
          TX packets:81935 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:12295231 (11.7 Mb)  TX bytes:12295231 (11.7 Mb)

DA3:~$ #
```

If you wanted to see only the configuration of eth0, you would enter **ifconfig eth0**.

The ifconfig utility can also be used to manage network configuration settings. Some of the more commonly used ifconfig options include the following:

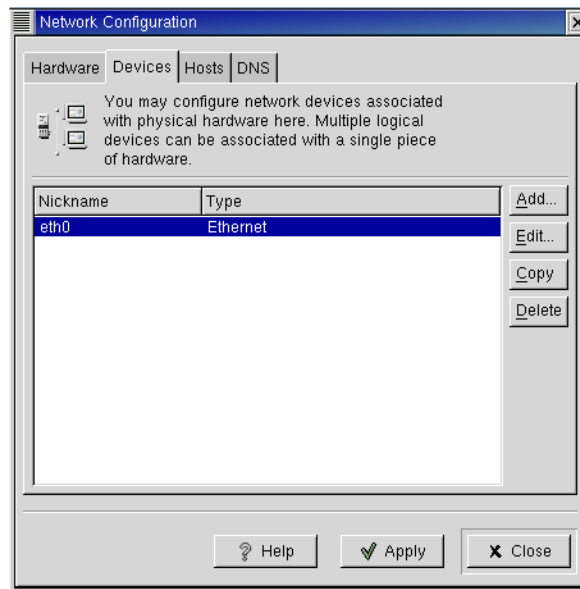
- **up/down.** This option enables or disables an interface. If you want to disable an interface, you can enter **ifconfig interface down**. For example, **ifconfig eth0 down**.  
To enable an interface, you can enter **ifconfig interface up**. For example, **ifconfig eth0 up**.
- **ip\_address.** This option assigns an IP address to an interface. To do this, you would enter **ifconfig interface ip\_address**. For example, to assign 192.168.1.1 to eth0, you would enter **ifconfig eth0 192.168.1.1**.
- **netmask mask.** This option assigns a subnet mask to an interface. You do this by entering **ifconfig interface netmask mask**. For example, to assign a subnet mask of 255.255.255.0 to eth0, you would enter **ifconfig eth0 netmask 255.255.255.0**.

### ***Configuring Network Interfaces from Red Hat***

Linux network interfaces can also be administered with a graphical utility from within X Windows. On a Red Hat Linux server, this is done with the Network Configuration utility.

This utility is run by selecting **Start Here > System > Network Configuration**. The following appears:

**Figure 1-25**



To add a new network board, select the **Hardware** tab and select **Add**. To add a new interface, select the **Devices** tab and select **Add**.

To edit configuration information for an existing interface, select **Devices** and select the *interface*; then select **Edit** and supply the appropriate *parameters*.

To add an entry to the /etc/hosts file, select the **Hosts** tab and add or edit a *name mapping*.

To configure the system hostname and DNS server address, select the **DNS** tab; then supply the appropriate *parameters*.

### ***Configuring Network Interfaces from SuSE***

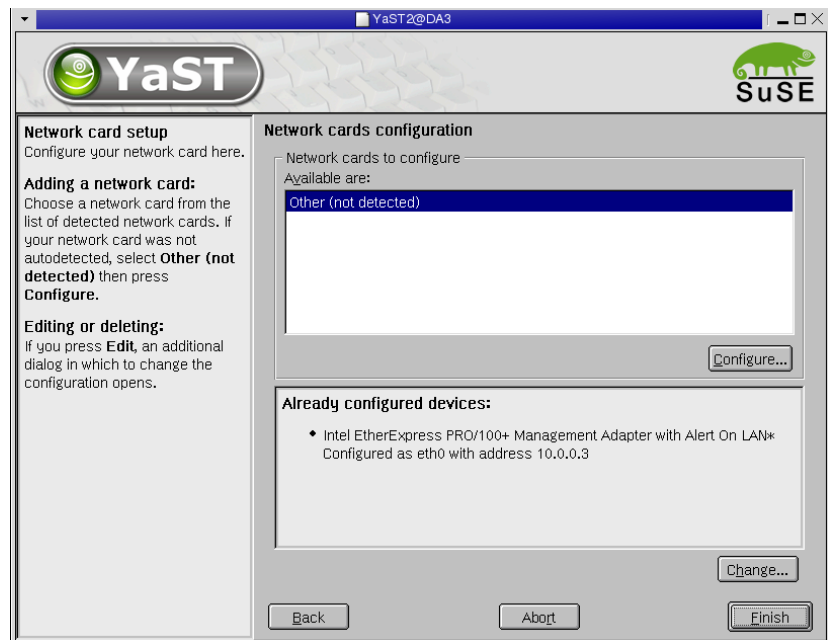
Linux network interfaces can also be administered with a graphical utility from within X Windows. On a SuSE Linux server, this is done with the YaST.

To use YaST to configure network interfaces, do the following:

1. From your desktop panel, select the **YaST** icon
2. (Conditional) If prompted for a password, enter the root (super user) password.
3. On the left, select **Network/Basic**; then on the right select **Network Card Configuration**.

The following appears:

Figure 1-26



From this dialog, you can configure network cards not yet configured, or change the configuration of network cards already configured.

If you select **Configure**, you can configure existing network cards.

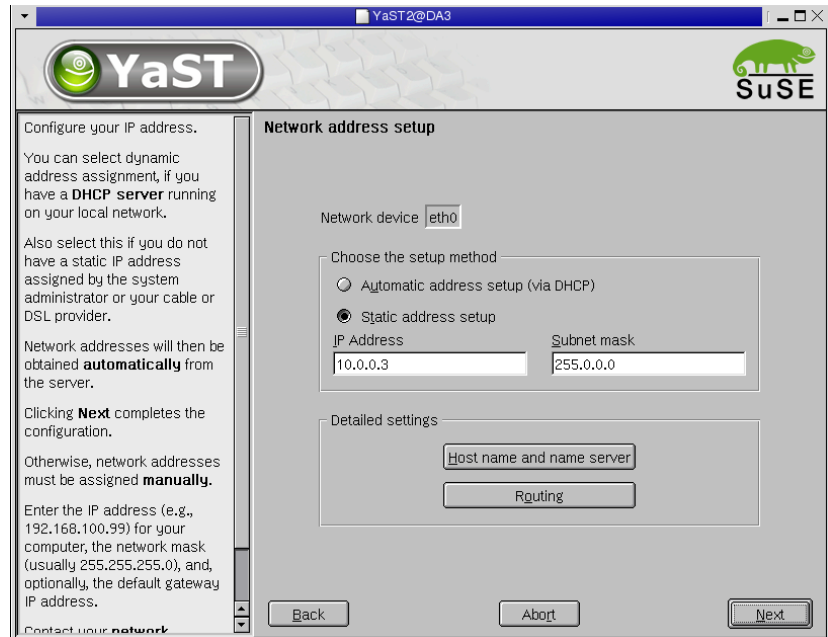
If you select **Change**, you can add, edit or delete network cards.

To edit an configured network card, do the following:

4. Select **Change > network card > Edit**.

A dialog similar to the following appears.

Figure 1-27



From here you can modify settings such as Static IP address, hostname and name server, and routing.

5. When you finish, select **Next > Finish**.

All configuration changes are saved to the appropriate files.

6. Close the YaST Control Center by selecting **Close**.



**15 Minutes**

This exercise is required for students to be able to successfully complete other exercises in the course.

### ***Exercise 1-5    Configuring Network Parameters***

When your server was installed, it was configured to use DHCP to get its IP networking configuration. However, NNLS requires a static IP address.

In this exercise, you configure your server with a static IP address, subnet mask, router address, hostname, and DNS server address.

Do the following:

1. Make sure you are logged in to the desktop as **student** with a password of **novell**.
2. From the top panel of the desktop, select the **YaST** icon.
3. When prompted, enter the root password of **novell** (ignore the “failed” message).

The YaST Control Center appears.

4. On the left, select **Network/Basic**.
5. On the right, select **Network card configuration**.
6. Under the Already configured devices list, select **Change**.
7. Select **Edit**.
8. Select **Static address setup**.

9. In the IP Address and Subnet mask fields, enter the appropriate *information* for your assigned server:

Table 1-1

Server	Parameters
DA3	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.3</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA3</b></li> <li>■ Domain name: <b>atl.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA4	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.4</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA4</b></li> <li>■ Domain name: <b>boi.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA5	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.5</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA5</b></li> <li>■ Domain name: <b>bwi.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA6	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.6</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA6</b></li> <li>■ Domain name: <b>day.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>

**Table 1-1** *(continued)*

<b>Server</b>	<b>Parameters</b>
DA7	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.7</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA7</b></li> <li>■ Domain name: <b>del.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA8	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.8</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA8</b></li> <li>■ Domain name: <b>dfw.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA9	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.9</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA9</b></li> <li>■ Domain name: <b>gtf.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA10	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.10</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA10</b></li> <li>■ Domain name: <b>iad.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>

**Table 1-1** *(continued)*

<b>Server</b>	<b>Parameters</b>
DA11	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.11</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA11</b></li> <li>■ Domain name: <b>ida.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA12	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.12</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA12</b></li> <li>■ Domain name: <b>lax.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA13	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.13</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA13</b></li> <li>■ Domain name: <b>lga.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA14	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.14</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA14</b></li> <li>■ Domain name: <b>lon.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>

**Table 1-1** *(continued)*

<b>Server</b>	<b>Parameters</b>
DA15	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.15</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA15</b></li> <li>■ Domain name: <b>mci.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA16	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.16</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA16</b></li> <li>■ Domain name: <b>mem.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA17	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.17</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA17</b></li> <li>■ Domain name: <b>mia.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA18	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.18</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA18</b></li> <li>■ Domain name: <b>pdx.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>

**Table 1-1** *(continued)*

<b>Server</b>	<b>Parameters</b>
DA19	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.19</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA19</b></li> <li>■ Domain name: <b>phx.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA20	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.20</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA20</b></li> <li>■ Domain name: <b>syd.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA21	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.21</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA21</b></li> <li>■ Domain name: <b>txl.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>
DA22	<ul style="list-style-type: none"> <li>■ IP Address: <b>10.0.0.22</b></li> <li>■ Subnet mask: <b>255.0.0.0</b></li> <li>■ Host name: <b>DA22</b></li> <li>■ Domain name: <b>tyo.digitalairlines.com</b></li> <li>■ Default gateway: <b>10.0.0.1</b></li> <li>■ Name server 1: <b>10.0.0.1</b></li> </ul>

10. Select the **Host name and name server** button.  
A message appears informing you about the resolv.conf file parameters.
11. Continue by selecting **Modify**.
12. Enter the information for **Host name**, **Domain name**, and **Name server 1** for your assigned Linux server from Table 1-1.
13. Make sure the **Domain search 1** field is empty (delete any default setting).
14. When you finish, select **Next**.
15. Select the **Routing** button.
16. Enter the information for Default gateway for your assigned Linux server from Table 1-1.
17. When you finish, select **Next**.
18. Return to the Network cards configuration overview screen by selecting **Next**.
19. Save your configuration changes by selecting **Finish**.
20. Close the YaST Control Center by selecting **Close**.
21. Open a terminal session and log in as root by entering **su -** and a password of **novell**.
22. Verify that your changes have been applied by entering **ifconfig**.

23. Verify that your gateway and DNS settings have been entered correctly by doing the following:
- Verify that your gateway address is configured properly by entering **traceroute 128.59.16.20**.  
The route for 128.59.16.20 is displayed.  
If routing is operating correctly, you should see “columbia.edu” at the end of the route.
  - Verify that your DNS server address is configured properly by entering the following:  
**nslookup -sil dax.your container.digitalairlines.com**  
For example, if your server is DA3, you would enter **nslookup -sil da3.atl.digitalairlines.com**.  
Make sure that the DNS service on DA1 returns the correct address for your server.
  - Verify that DNS is resolving domain names for other servers on the network by using the **ping** command.  
For example, for DA4, enter **ping da4.boi.digitalairlinesl.com**.  
You can stop the pinging by pressing **Ctrl+C**.
24. Exit the root session by entering **exit**.
25. Close the terminal session window.

*(End of Exercise)*



## Summary

Objective	Summary
1. Describe the Characteristics of Linux	<p>Linux is an operating system that is similar to UNIX®. Linux was first developed by Linus Torvalds in the early 1990s.</p> <p>Torvalds studied an existing freeware version of UNIX called Minix and used this knowledge to develop a new operating system he dubbed "Linux." Linux version 1.0 was released in 1994.</p> <p>Linux is developed under the General Public License (GPL). Unlike other operating systems, developers are allowed to modify the Linux source code and recompile it to suit their needs.</p> <p>Linux is Open Source software.</p> <p>To describe the characteristics of Linux, you need to know the following:</p> <ul style="list-style-type: none"><li>■ The Role of Linux</li><li>■ Working with Linux Distributions</li><li>■ Working with the Linux File System</li></ul>

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Objective	Summary
2. Use the Linux Command Line Interface	<p>Linux is essentially a command-line operating system. Many tasks still have to be performed from a command prompt.</p> <p>Commonly used Linux commands and utilities include the following:</p> <ul style="list-style-type: none"><li>■ init 0 and halt</li><li>■ init 6 and reboot</li><li>■ man and info</li><li>■ top</li><li>■ netstat</li><li>■ ifconfig</li><li>■ route</li><li>■ which</li><li>■ env</li><li>■ su</li><li>■ setup</li><li>■ startx</li></ul>

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Objective	Summary
3. Manage the Linux File System	<p>Linux organizes its file system using a hierarchical tree structure.</p> <p>The directories used in a Linux system are defined by the File System Hierarchy standard in the Linux Standards Base.</p> <p>Some of the important default Linux directories include the following:</p> <ul style="list-style-type: none"><li>■ /etc</li><li>■ /dev</li><li>■ /usr</li><li>■ /var</li><li>■ /tmp</li><li>■ /home</li><li>■ /root</li><li>■ /bin</li><li>■ /sbin</li><li>■ /mnt (Red Hat) or /media (SuSE)</li></ul>

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Objective	Summary
3. Manage the Linux File System (continued)	<p>Common commands for managing the Linux file system include:</p> <ul style="list-style-type: none"><li>■ cp</li><li>■ mv</li><li>■ rm</li><li>■ cd</li><li>■ ls</li><li>■ dir</li><li>■ pwd</li><li>■ mkdir</li><li>■ rmdir</li><li>■ more</li><li>■ less</li><li>■ grep</li><li>■ find</li><li>■ cat</li><li>■ tail</li></ul> <p>Unlike Windows or DOS, floppies or CDs are not immediately usable when they are inserted in a Linux system. They must first be mounted into the file system using the <b>mount</b> command.</p>

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Objective	Summary
4. Manage Linux Applications	<p>There are 3 different ways applications can be installed on a Linux system:</p> <ul style="list-style-type: none"><li>■ Untarring an archive and using an installation script to copy and modify the appropriate files.</li><li>■ Using RPM Package Manager to install an RPM file.</li><li>■ Using YaST on SuSE distributions to install files</li></ul> <p>You can use 2 utilities to install or uninstall an RPM package:</p> <ul style="list-style-type: none"><li>■ rpm</li><li>■ Gnome RPM</li></ul> <p>To install an RPM package with rpm, you would enter the following:</p> <p><b><code>rpm -ihv package_file_name</code></b></p> <p>From the YaST Control Center you can use <b>Install or remove software</b> or <b>Online Update</b> to install, remove, and update your system.</p>

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Objective	Summary
4. Manage Linux Applications (continued)	<p>To start a service, change to the /etc/rc.d/init.d directory (Red Hat) or the /etc/init.d directory (SuSE) and enter <b>.<i>service_name</i> start</b>.</p> <p>To stop a service, change to the /etc/rc.d/init.d directory (Red Hat) or the /etc/init.d directory (SuSE) and enter <b>.<i>service_name</i> stop</b>.</p> <p>You can view the currently running processes on your Linux system with the <b>top</b> utility:</p> <p>A graphical version is available (called System Monitor) with the GNOME window manager on some distributions (such as Red Hat):</p>
5. Manage Linux Network Interfaces	<p>Linux network interfaces for Ethernet are labeled eth0, eth1, eth2, etc. For PCI network adapters, the adapter with the lowest slot number is usually assigned to eth0. The next highest adapter is assigned eth1, and so on.</p> <p>The localhost loopback interface (which is configured with an IP address of 127.0.0.1) is assigned to the lo interface. The lo interface is always configured, even if the PC doesn't have a network board physically installed.</p> <p>There are 2 ways to configure Linux network interfaces:</p> <ul style="list-style-type: none"><li>■ From the command line with ifconfig</li><li>■ From within XWindows with Network Configuration (Red Hat) or YaST (SuSE)</li></ul>

## SECTION 2    Install and Upgrade Novell Nterprise Linux Services

In this section you learn how to prepare your Linux® server for a Novell® Nterprise™ Linux Services (NNLS) installation, install NNLS, and update NNLS with patches from the Red Carpet Enterprise™ (RCE) server.

### Objectives

1. Describe Novell Nterprise Linux Services (NNLS)
2. Perform an NNLS Installation
3. Manage NNLS with Red Carpet

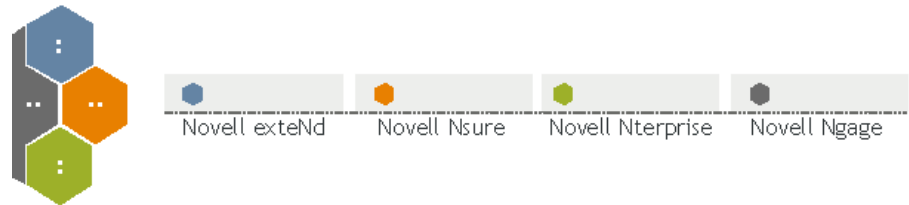
### Introduction

Novell's oneNet vision includes providing information without boundaries so the right people are connected with the right information at the right time to make the right decisions.

Since it announced oneNet in 1999, Novell has been working to identify and develop the technologies, products, and solution suites that make the vision a reality for our customers.

The oneNet vision includes the following product/solution families:

**Figure 2-1**



- **Novell Ngage<sup>SM</sup>.** Ngage consulting services teams employ proven methodologies and expertise, training, and support at all levels of your organization to facilitate the design, development, and deployment of secure, scalable business solutions.
- **Novell exteNd<sup>TM</sup>.** Novell exteNd is our integrated development environment for the creation of Web services-based solutions that help transform rigid “silo” applications into personalized, standards-based, process-driven secure Web solutions.
- **Novell Nsure<sup>TM</sup>.** Our secure identity management solutions family, Novell Nsure, delivers your enterprise resources and business information based on who people are and what they need, wherever they need it.
- **Novell Nterprise.** Novell Nterprise is an innovative family of products which give you the power to enable and manage the constant interaction of people with your business systems—regardless of who they are, where they are, or what time of day it happens to be. It provides the best foundation for your mixed environment.

Novell Nterprise Linux Services (NNLS) is a suite of enterprise-ready software which allows organizations that are embracing Linux as an OS strategy to economically replace Windows® servers and extend traditional NetWare® services to the Linux platform.



NNLS brings you closer to the Novell promise of oneNet, enabling you to extend the open platform with the comprehensive set of network services needed to enable and manage the constant interaction of people with your business systems.

With NNLS there is no need to “rip and replace” your existing systems. As part of Novell’s oneNet strategy, NNLS is designed to enable all your disparate systems to work together.

## **Objective 1      Describe Novell Nterprise Linux Services (NNLS)**

Novell Nterprise Linux Services (NNLS) v1.0 lets you combine the open-source benefits of Linux with the powerful set of enterprise services previously only available on NetWare, including the following:

- Identity Services
- Personal File Management Services
- Print Services
- Messaging and Calendaring Services
- Web Experience
- Resource Management Services
- Web-Based Administration

You might have questions at this point about NNLS running on other distributions of NNLS.

Make sure students understand that these are the only Linux distributions currently supported by Novell.

Students might be able to install or load NNLS services on distributions such as Red Hat® 7.3, Red Hat 9, or SuSE® 8.2, but there are no guarantees and no support from Novell for these distributions.

NNLS v1.0 is ideal for early adopters of Linux and runs on the following Linux enterprise versions:

- SuSE® Linux Enterprise Server 8 (SLES 8)
- Red Hat® Enterprise Linux AS 2.1
- Red Hat Enterprise Linux ES 2.1

### ***Identity Services***

The identity services in NNLS strengthen enterprise security and decrease management costs of cross-platform business systems.

These services provide secure, customized access to network applications and data. They also let you store, manage, and synchronize user information.

NNLS offers the following identity service components:

- **eDirectory™ 8.7.3**

Novell eDirectory is the foundation for the world's largest identity management deployments—allowing businesses to manage identities and control access for employees, customers, and partners.

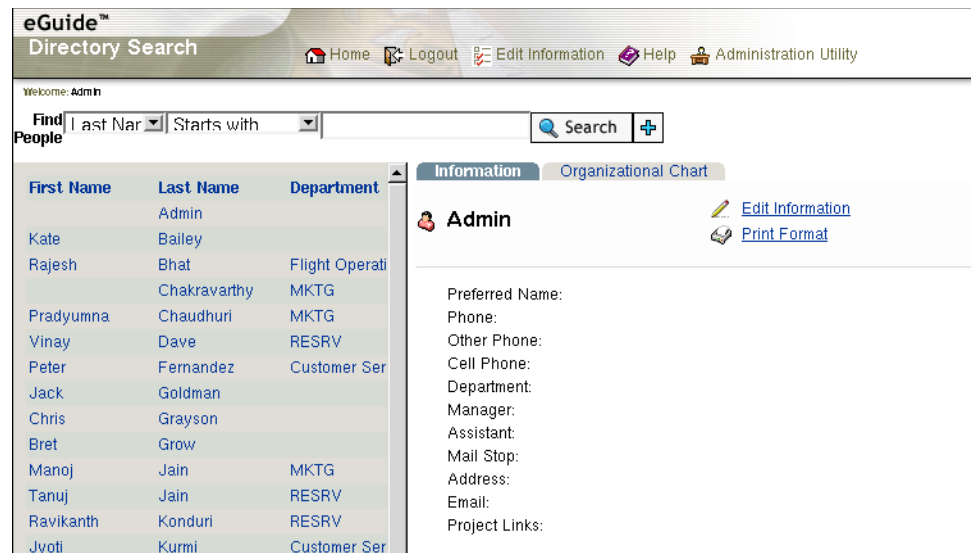
With Novell eDirectory, the industry's first and most advanced full-service directory, businesses lay the groundwork for complete secure identity management solutions and multi-platform network services.
- **Novell eGuide 2.12**

eGuide is a web application that lets you search for and view information about people, places, and things stored in eDirectory and other LDAP data sources at the same time.

eGuide looks like an address book and can be accessed by any user with rights to your Web server via a standard web browser.

The following shows the main page of eGuide:

Figure 2-2



#### ■ DirXML® Starter Pack

Novell DirXML is a data sharing service that runs on Novell eDirectory.

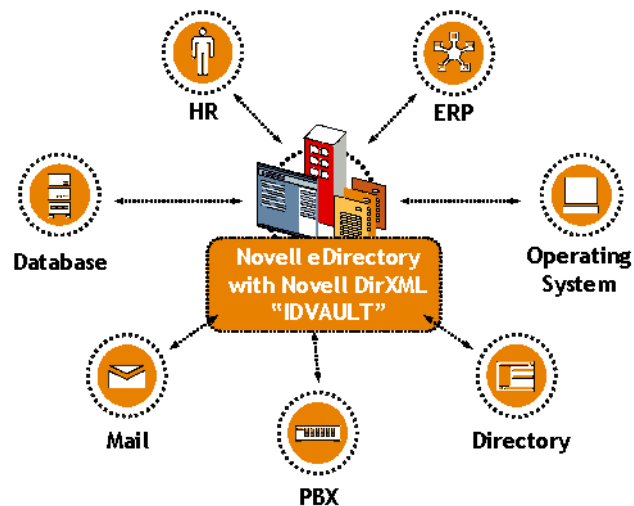
DirXML enables an application to bi-directionally share and synchronize selected data with eDirectory and with other applications connected to eDirectory through DirXML drivers.

DirXML Starter Pack comes with the following licensed drivers:

- ❑ eDirectory
- ❑ NT® Domains
- ❑ Active Directory™

With DirXML, eDirectory acts as a hub for synchronizing and sharing selected data across the network:

Figure 2-3



#### ■ Linux User Management (LUM) 2.1

LUM is a Novell eDirectory-based service for Linux systems that allows eDirectory users to log in as Linux users and leverage Linux resources.

LUM lets users authenticate against an eDirectory user object for access to Linux services without an entry in the *passwd* file.

### ***Personal File Management Services***

Personal file management services let your users' critical business data securely follow them, no matter where they go or what machine they happen to be using at the time.

NNLS offers the following personal file management service components:

### ■ iFolder® 2.1.2

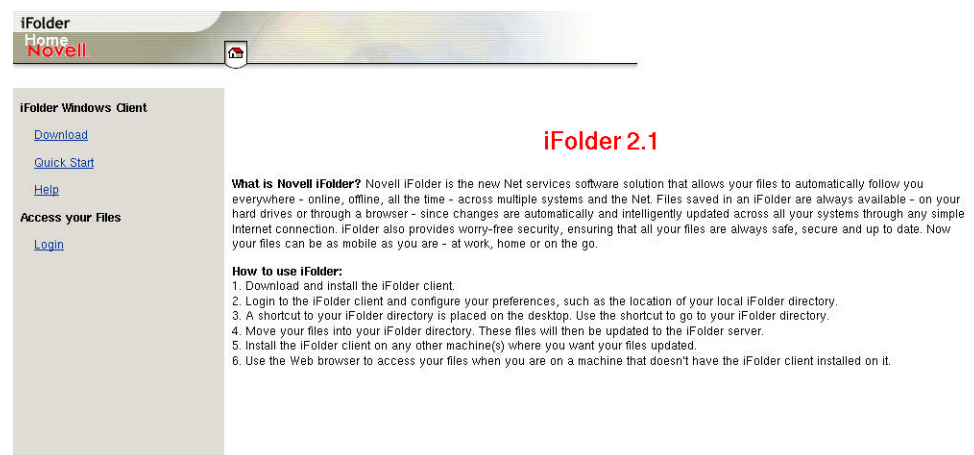
Novell iFolder is a Net services software solution that lets mobile professionals access their local files from anywhere—online, offline, all the time—across multiple workstations and the Net.

iFolder automatically and intelligently updates your files across desktop computers, laptops, and other connected devices you use, letting you use them wherever you happen to be—at the office, at home, or in a hotel.

iFolder synchronizes your files from a central iFolder server. The data stored on the central iFolder server acts as a backup of local data, which is often not backed up any other way.

The following is the default iFolder web site:

**Figure 2-4**



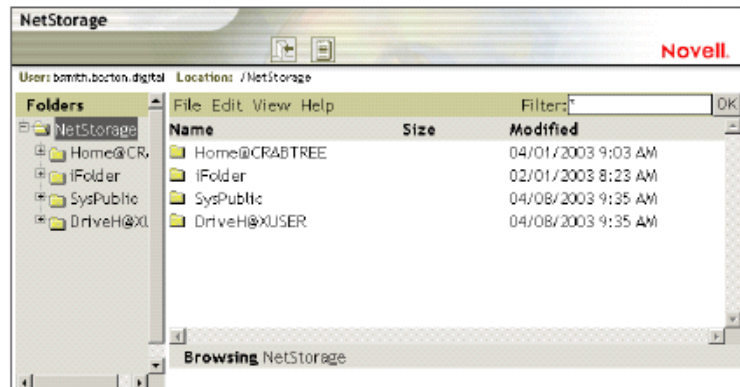
### ■ NetStorage 3.0

NetStorage provides secure Internet-based access to files and folders on Linux and NetWare servers in your network through a browser.

NetStorage authentication relies on Novell eDirectory to provide secure access, so Internet-based access is as secure as accessing files from within the network.

The following illustrates files accessible from the NetStorage web page:

**Figure 2-5**



#### ■ Samba 2.2.8a

Samba is a software package that implements Microsoft's SMB/CIFS networking protocols on Linux.

It allows a Linux machine to function as a Windows-compatible file server and to act as a client to other Windows servers.

### ***Print Services***

Print services in NNLS let users easily print from any location and reduce help desk calls.

NNLS offers the following print service component:

#### ■ iPrint 5.0

iPrint provides support for IPP standard-based printing for Windows, Mac™, and Linux clients, allowing mobile employees, business partners, and customers access printers from a variety of remote locations using existing Internet connections.

### ***Messaging and Calendaring Services***

Messaging and calendaring services let you promote productive collaboration and easily scale to match your organization's growth.

NNLS offers the following messaging service components:

- **NetMail™ 3.5**

Novell NetMail is a scalable, high-performance e-mail and calendaring system that is based on Internet-standard messaging and security protocols.

NetMail connects users to a scalable, secure e-mail and calendaring system for standards-based messaging and calendaring (supports up to 30,000 users per NNLS server).

- **GroupWise® Client 6.5.1**

The Novell GroupWise client for Windows is provided in your NNLS package as an alternative interface for users to access their email.

### ***Web Experience***

A central web experience provides integrated access of NNLS to customers, employees and partners, anytime, anywhere.

NNLS offers the following web experience component:

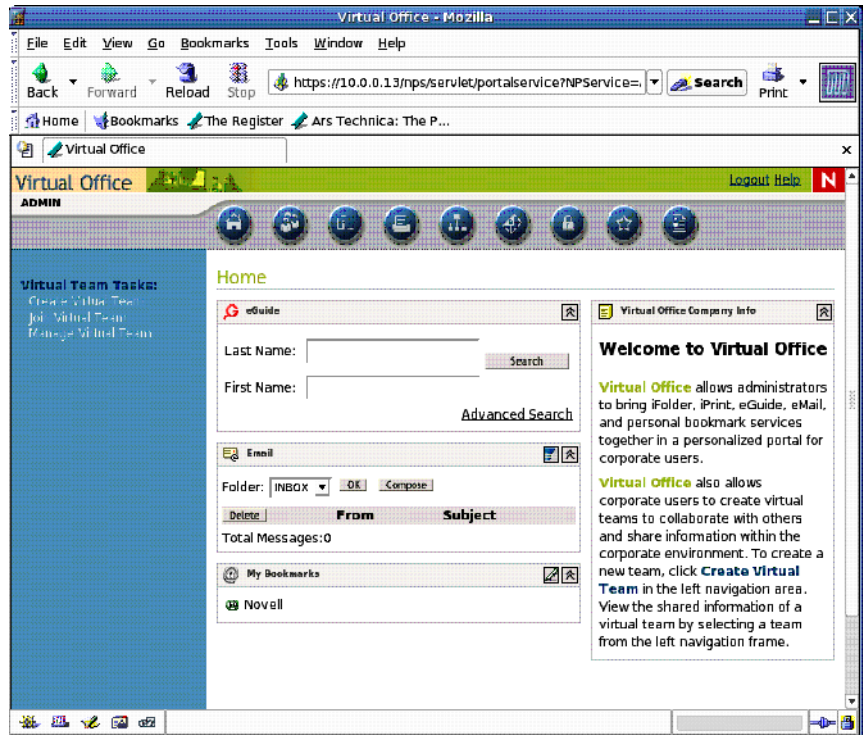
- **Virtual Office 1.0.1**

Virtual Office is a web access interface (a web portal) that addresses the need for users to be self-sufficient in filling their workstation and team collaboration needs.

Virtual Office provides a unified web access experience with customized gadgets to NNLS services

The following is the default Virtual Office welcome (login) page:

Figure 2-6





## ***Resource Management Services***

Resource management services provided by Red Carpet let you upgrade NNLS products on 1 or more Linux servers at a time.

NNLS offers the following resource management component:

- **Red Carpet (1.4) Daemon**

The Red Carpet Daemon (RCD) is designed to help you manage the software you have on your server. It can help you install, update, and remove programs, without making you keep track of the dependencies and conflicts yourself.

## ***Web-Based Administration***

Web-based administration is available through tools such as Novell iManager for simplifying and reducing the costs of managing your business system platforms.

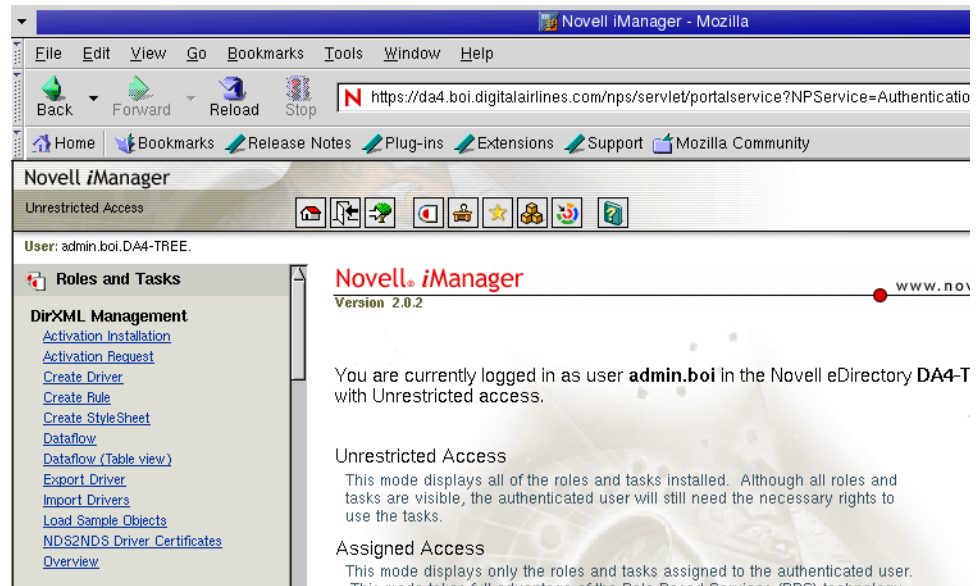
NNLS offers the following administration and management components:

- **iManager 2.0.2**

Novell iManager is a state-of-the-art web-based administration console for eDirectory that provides customized access to network administration utilities and content from virtually any location in the world—and it does so securely, whether inside or outside the firewall.

The following is the Novell iManager home page:

**Figure 2-7**



In addition, iManager lets you define user-management roles to delegate eDirectory administration, management, and services tasks.

- **iMonitor**

Novell iMonitor provides cross-platform monitoring and diagnostic capability to all servers in your eDirectory tree.

- **NetMail WebAdmin 4.0**

You use this utility for administration of NetMail.

## Objective 2      Perform an NNLS Installation

To install the components of NNLS, you need to know the following:

- How to Obtain NNLS Software and Licenses
- How to Prepare for an NNLS Installation
- How to Install NNLS
- How to Recover From a Failed Apache Process Start
- Understand NNLS File and Data Locations
- How to Uninstall NNLS Components
- Install NNLS Components After Initial Installation
- How to Configure SLP on Your Linux Server

### ***How to Obtain NNLS Software and Licenses***

NNLS is only available via Internet download (ISO image) and must be purchased through an Authorized Novell Reseller or [www.novell.com/products/linux](http://www.novell.com/products/linux) on Novell's Web site.

You will receive an email with a URL for downloading the following files:

- **An eDirectory NCI Foundation Key (\*.nfk)** that is required during the installation.
- **Novell\_Nterprise\_Linux\_Services\_1.0.iso** which contains a CD image with files to install NNLS on your Linux server.
- **Novell\_Nterprise\_Linux\_Services\_1.0\_Companion\_CD.iso** which contains a CD image with files to install
  - The Novell GroupWise Collaboration Client for Windows
  - Novell DirXML drivers for Windows and NetWare
  - Novell NetDrive client

### ***How to Prepare for an NNLS Installation***

To prepare for installing NNLS products (such as eDirectory), you need to check the following:

- Linux Server Configuration Requirements
- Server Time Synchronization
- System Software Requirements
- Disk Space Requirements
- Hardware Requirements
- Information Required to Custom Install NNLS
- The HOSTS File
- Multicast Routing

### **Linux Server Configuration Requirements**

The Linux server must meet the following specific requirements before beginning the NNLS install:

- Use Only the Hostname
- Assign Static IP Address
- Stop RPM Management Programs

#### **Use Only the Hostname**

When you are prompted for a hostname, during the installation of Linux on your target server, do not include the DNS domain name. For example, enter DA5. *Do not* enter DA5.digitalairlines.com.

If you include the domain name with the hostname, eDirectory and other NNLS components will not install correctly.

### Assign Static IP Address

You must assign the Linux server a static IP address prior to installing NNLS.



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You assigned a static IP address to your Linux server in Exercise 1-5.

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### Stop RPM Management Programs

Any RPM management tools that lock the database must be stopped before starting the NNLS installation.

### Server Time Synchronization

If you are installing NNLS into an existing eDirectory tree, or if you plan to install NNLS on multiple servers using the same eDirectory tree, you must ensure that the system time on each server is synchronized prior to installing NNLS.

You can synchronize time between NetWare, Linux, and Windows servers by using Network Time Protocol (NTP).



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Information on setting up NTP support on Linux is available in various locations on the Web, such as the Network Time Protocol Project website at [www.ntp.org](http://www.ntp.org) and The Linux Documentation Project at [www.tldp.org](http://www.tldp.org).

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To perform a quick, one-time update with the rest of the network, enter the following command at the shell prompt:

***ntpdate ip\_address\_of\_time\_provider***

For example, to synchronize the Linux server with an NTP time provider whose IP address is 10.0.0.1, enter **ntpdate 10.0.0.1**. The following appears:

**Figure 2-8**

```
student@DA4:~$ su -
Password:
DA4:~$ # ntpdate 10.0.0.1
3 Feb 16:44:35 ntpdate[32001]: adjust time server 10.0.0.1 offset 0.022676 sec
DA4:~$ # ntpdate 10.0.0.1
3 Feb 16:44:45 ntpdate[32002]: adjust time server 10.0.0.1 offset 0.017862 sec
DA4:~$ #
```

## System Software Requirements

Novell supports NNLS installed on the Linux distributions outlined in the following:

**Table 2-1**

To avoid unexpected issues, we don't update to the latest patch level in this class.

Component	Required Software
Operating System (which should be updated to the latest patch level)	One of the following: <ul style="list-style-type: none"> <li>■ SLES 8</li> <li>■ Red Hat Enterprise Linux AS 2.1 (formerly Red Hat Linux Advanced Server 2.1)</li> <li>■ Red Hat Enterprise Linux ES 2.1 (formerly Red Hat Linux Enterprise Server 2.1)</li> </ul>
The gettext RPM	This RPM must be installed for the installation script (install.sh) to run properly.

The NNLS installation attempts to replace and overwrite any included products that were previously installed on the server.

## Disk Space Requirements

When partitioning your server's hard drives, make sure you allow for the following directory space requirements, whether through a separately designated partition or as part of the / partition:

**Table 2-2**

Directory Name	Minimum Disk Space Required
/var	350 MB
/opt	100 MB
/usr	310 MB

Note that Red Hat and the SLES 8 default partitioning mechanisms do not match these requirements.

As will be discussed in more detail later, the /var directory contains variable data related to NNLS components. This data is variable in the sense that it changes and can increase in size. iFolder data is stored in this directory, so it is important to take into account that disk space requirements for user's iFolder data will grow quickly.

## Hardware Requirements

The following table lists the hardware and software requirements that must be met to install all Novell Nterprise Linux Services:

**Table 2-3**

Component	Minimum	Recommended
Server	Server-class hardware	Server-class hardware
Processor	Pentium II	Pentium 4 CPU running at 1.5 GHz
Memory (RAM)	512 MB	1 GB

## Information Required to Custom Install NNLS

Before installing NNLS components, you need to know the following:

- NNLS Component Dependencies
- NNLS Component Required Information

### NNLS Component Dependencies

The following table summarizes the dependencies of each NNLS component. The NNLS install script takes care of each dependency automatically, depending on the components you select. But it is useful to know what the installation is doing in the background and where to look if you need to troubleshoot.

**Table 2-4**

Component	Dependencies
Apache Web Server 2.0.45	None
JVM™ 1.4.1_02	None
Tomcat 4.1.24	JVM 1.4.1_02
eDirectory 8.7.3	None
Linux User Management (LUM) 2.1.2	Requires eDirectory 8.7.1 or later anywhere within the network.
DirXML 1.1a	Requires eDirectory 8.7.1 or later on the same NNLS server.
eGuide 2.1	Apache Web Server 2.0.45 JVM 1.4.1_02 Tomcat 4.1.24
Samba	Requires eDirectory 8.7.1 or later anywhere within the network.



**Table 2-4** *(continued)*

Component	Dependencies
iFolder 2.1	Apache* Web Server 2.0.45 Requires eDirectory 8.7.1 or later anywhere within the network.
NetMail	Requires eDirectory 8.7.1 or later anywhere within the network.
iManager 2.0	Apache 2.0.45 on the same NNLS server. JVM 1.4.1_02 on the same NNLS server. Tomcat 4.1.24 on the same NNLS server. eDirectory 8.7.1 or later anywhere within the network.
iPrint	Apache Web Server 2.0.45 Requires eDirectory 8.7.1 or later anywhere within the network.
Virtual Office	Apache 2.0.45 on the same NNLS server. JVM 1.4.1_02 on the same NNLS server. Tomcat 4.1.24 on the same NNLS server. eDirectory 8.7.1 or later anywhere within the network. iManager 2.0
Red Carpet Client	None

**NNLS Component Required Information**

The following table outlines information that you need to know before running the installation script.

**Table 2-5**

<b>Component/ Data Required</b>	<b>Description</b>
<b>Apache Web Server 2.0.45</b>	
<b>JVM 1.4.1_02</b>	
<b>Tomcat 4.1.24</b>	
<b>eDirectory 8.7.3</b>	
<ul style="list-style-type: none"> <li>■ The NCI Foundation Key</li> </ul>	This file must be accessible while install.sh is running. For example, if the file is located on a floppy disk, the disk must be mounted before running install.sh.
<ul style="list-style-type: none"> <li>■ New Tree or Existing Tree</li> </ul>	You must indicate whether this eDirectory installation will create a new tree on the network or become part of an existing tree.
<ul style="list-style-type: none"> <li>■ Server Time Synchronization</li> </ul>	If you are installing into an existing tree, you will be required to certify that the server times have been synchronized.
<ul style="list-style-type: none"> <li>■ Tree Name</li> </ul>	<p>If you are creating a new tree, this must be a network-unique name for the tree.</p> <p>If you are installing into an existing tree, this must be the name of an accessible tree on the network.</p>
<ul style="list-style-type: none"> <li>■ Existing Server IP Address</li> </ul>	This appears only when you are installing into an existing tree and is the primary IP address of the eDirectory server that contains the existing tree.

**Table 2-5** *(continued)*

Component/ Data Required	Description
■ Admin Name with Context	<p>This is the Admin name and fully distinguished context within the eDirectory tree. The information must be specified using typeful syntax (<code>cn=<i>name</i>.ou=<i>organizationalunit</i>.o=<i>organization</i></code>).</p> <p>If you are creating a new tree, this Admin will have administrative rights to the tree.</p> <p>If you are installing into an existing tree, this must be the name and context of an Admin with administrative rights to the tree.</p>
■ Admin Password	The password for the Admin specified above.
■ Server Context	<p>This is the eDirectory context in which an object for this server will be created. The information must be specified using typeful syntax (<code>ou=<i>organizationalunit</i>.o=<i>organization</i></code>).</p> <p>If you are creating a new tree, this context will be created. If you are installing into an existing tree, the context should already exist.</p>
■ LDAP Port	<p>The LDAP port the server should use for communicating with eDirectory.</p> <p>The default value is 389.</p>
■ LDAP Secure Port	<p>The secure LDAP port the server should use for communicating with eDirectory.</p> <p>The default value is 636.</p>
■ HTTP Port	<p>The HTTP port on the network through which administrators will monitor and manage servers in the eDirectory tree using iMonitor.</p> <p>The default value is 81.</p>

**Table 2-5** *(continued)*

<b>Component/ Data Required</b>	<b>Description</b>
■ HTTPS Port	<p>The HTTPS port on the network through which administrators will monitor and manage servers in the eDirectory tree using iMonitor.</p> <p>The default value is 444.</p>
<b>Linux User Management (LUM)</b> <b>2.1.2</b>	
■ LDAP Server IP Address	<p>The primary IP address of the eDirectory server to which Linux users will authenticate using LDAP authentication for access to this server.</p> <p>Linux User Management objects and configuration information will also be stored and managed in eDirectory on the specified server.</p>
■ Admin Name with Context	<p>The fully distinguished name of the Admin of the eDirectory (LDAP) server specified for LUM.</p> <p>The name and context must be specified using typeful syntax (<i>cn=name.ou=organizational-unit.o=organization</i>).</p>
■ Admin Password	The password for the specified Admin.
■ LDAP Port	<p>The LDAP port through which Linux users will authenticate to the eDirectory server for access to the NNLS server being installed.</p> <p>The default value is 389.</p>

**Table 2-5** *(continued)*

Component/ Data Required	Description
■ Secure LDAP Port	<p>The secure LDAP port through which Linux users will authenticate to the eDirectory server for access to the NNLS server being installed.</p> <p>The default value is 636.</p>
■ Partition Root	<p>The base context used in LDAP searches for users, groups, and workstation objects.</p> <p>This context must be at the same level or higher than the Linux users, groups, and workstation objects in the tree.</p> <p>The context must be specified using typeful syntax (<i>ou=organizational-unit</i>, <i>o=organization</i>).</p>
■ Workstation Context	<p>The location in the eDirectory tree where install will create the LUM Workstation object.</p> <p>This context can be different for each server installed into the tree, but it must be in or below the context specified for the Partition Root.</p> <p>The context must be specified using typeful syntax (<i>ou=organizational-unit</i>, <i>o=organization</i>).</p>

**Table 2-5** *(continued)*

Component/ Data Required	Description
<ul style="list-style-type: none"> <li>■ PAM-Enabled Services that authenticate through eDirectory: <ul style="list-style-type: none"> <li>■ ftp</li> <li>■ su</li> <li>■ sshd</li> <li>■ rsh</li> <li>■ login</li> <li>■ rlogin</li> <li>■ passwd</li> </ul> </li> </ul>	You must decide which of the services listed will be available to users who authenticate using Linux User Management.
<b>DirXML 1.1a</b>	
<ul style="list-style-type: none"> <li>■ Tree Name</li> </ul>	The name of the eDirectory tree that DirXML will work with.
<ul style="list-style-type: none"> <li>■ Admin Name with Context</li> </ul>	<p>The fully distinguished name of the Admin for the eDirectory tree specified for DirXML.</p> <p>The name and context must be specified using typeful syntax (<i>cn=name.ou=organizational-unit.o=organization</i>).</p>
<ul style="list-style-type: none"> <li>■ Admin Password</li> </ul>	The password for the Admin.
<b>eGuide 2.1</b>	
<ul style="list-style-type: none"> <li>■ LDAP Server IP Address</li> </ul>	<p>The primary IP address of the eDirectory server to which Linux users will authenticate using LDAP authentication for access to this server.</p> <p>Linux User Management objects and configuration information will also be stored and managed in eDirectory on the specified server.</p>

**Table 2-5** *(continued)*

Component/ Data Required	Description
■ LDAP Port	The LDAP port through which Linux users will authenticate to the eDirectory server for access to the NNLS server being installed.  The default value is 389.
■ Secure LDAP Port	The secure LDAP port through which Linux users will authenticate to the eDirectory server for access to the NNLS server being installed.  The default value is 636.
■ Admin Name with Context	The fully distinguished name of the Admin for the eDirectory tree specified for DirXML.  The name and context must be specified using typeful syntax (cn= <i>name</i> .ou= <i>organizational-unit</i> .o= <i>organization</i> ).
■ Admin Name with Context	The fully distinguished name of the Admin for the eDirectory tree specified for DirXML.  The name and context must be specified using typeful syntax (cn= <i>name</i> .ou= <i>organizational-unit</i> .o= <i>organization</i> ).
<b>Samba</b>	
■ eDirectory Server IP Address	Indicates the primary IP address or DNS hostname of the eDirectory server that has its eDirectory schema extended for this Samba installation.  The server must have a master or read/write replica of eDirectory installed.
■ Admin Name with Context	The fully distinguished name of the Admin for the eDirectory tree specified for DirXML.  The name and context must be specified using typeful syntax (cn= <i>name</i> .ou= <i>organizational-unit</i> .o= <i>organization</i> ).

**Table 2-5** *(continued)*

<b>Component/ Data Required</b>	<b>Description</b>
■ Admin Password	The password for the Admin.
■ LDAP Server IP Address	<p>The primary IP address of the eDirectory server to which Linux users will authenticate using LDAP authentication for access to this server.</p> <p>Linux User Management objects and configuration information will also be stored and managed in eDirectory on the specified server.</p>
■ Samba Proxy User	<p>The name of the proxy user you want eDirectory to configure for Samba.</p> <p>The installation script creates this user object for you.</p>
■ Samba Proxy User Password	The password for the Samba proxy user.
■ LDAP Port	<p>The LDAP port through which Linux users will authenticate to the eDirectory server for access to the NNLS server being installed.</p> <p>The default value is 389.</p>
■ Secure LDAP Port	<p>The secure LDAP port through which Linux users will authenticate to the eDirectory server for access to the NNLS server being installed.</p> <p>The default value is 636.</p>
<b>iFolder 2.1</b>	



**Table 2-5** *(continued)*

Component/ Data Required	Description
■ LDAP Server IP Address	<p>The primary IP address of the eDirectory server to which Linux users will authenticate using LDAP authentication for access to this server.</p> <p>Linux User Management objects and configuration information will also be stored and managed in eDirectory on the specified server.</p>
■ LDAP Port	<p>The LDAP port through which Linux users will authenticate to the eDirectory server for access to the NNLS server being installed.</p> <p>The default value is 389.</p>
■ LDAP Admin Name with Context	<p>The fully distinguished name of the Admin for the LDAP server specified for iFolder.</p> <p>The name and context must be specified using typeful syntax (cn=name.ou=organizational-unit.o=organization).</p> <p>This is the context in which the iFolder objects are placed and is the context used for contextless login.</p>
■ Admin Password	<p>The password for the LDAP server Admin.</p>
■ iFolder Server IP Address	<p>The IP address or DNS name of the server on which you are installing iFolder.</p> <p>iFolder user directories and files are stored on the NNLS server.</p>
■ iFolder admin user names	<p>Additional users in the same context as the designated iFolder Admin who should also have management access to iFolder.</p> <p>Separate the user names using semi-colons (;).</p>

**Table 2-5** *(continued)*

<b>Component/ Data Required</b>	<b>Description</b>
<ul style="list-style-type: none"> <li>■ IFolder user data path</li> </ul>	<p>This is the location on the NNLS server where iFolder user data files are stored.</p> <p>The default is /var/opt/novell/ifolderdata.</p>
<b>NetMail</b>	
<ul style="list-style-type: none"> <li>■ Admin Name with Context</li> </ul>	<p>The fully distinguished name of the Admin for the eDirectory tree specified for DirXML.</p> <p>The name and context must be specified using typeful syntax (cn=<i>name</i>.ou=<i>organizational-unit</i>.o=<i>organization</i>).</p>
<ul style="list-style-type: none"> <li>■ Admin Password</li> </ul>	<p>The password for the Admin.</p>
<ul style="list-style-type: none"> <li>■ NetMail Primary DNS Server</li> </ul>	<p>The IP address of the primary server that is providing DNS services on your network.</p>
<ul style="list-style-type: none"> <li>■ NetMail Secondary DNS Server</li> </ul>	<p>(Optional) The IP address of the secondary server that is providing DNS services on your network.</p>
<ul style="list-style-type: none"> <li>■ Domain Name for NetMail Server</li> </ul>	<p>The domain name that is assigned, in DNS, to the server that you are installing NetMail on.</p>
<ul style="list-style-type: none"> <li>■ NetMail WebAccess HTTP Port</li> </ul>	<p>The non-secure port through which users will access the WebAccess web page.</p> <p>The default port assignment is 52080.</p>
<ul style="list-style-type: none"> <li>■ NetMail WebAccess HTTPS Port</li> </ul>	<p>The secure port through which users will access WebAccess.</p> <p>The default port assignment is 52443.</p>
<ul style="list-style-type: none"> <li>■ NetMail LDAP Port</li> </ul>	<p>The port for NetMail's MsgLDAP that is used for Address Book lookups</p> <p>The default port assignment is 52389.</p>
<b>iManager 2.0</b>	

**Table 2-5** *(continued)*

Component/ Data Required	Description
■ iManager Server IP Address	The IP address of the server on which iManager is being installed.
■ Admin Name with Context	<p>The fully distinguished name of the Admin for the eDirectory server specified for iManager.</p> <p>The name and context must be specified using typeful syntax (<code>cn=<i>name</i>.ou=<i>organizational-unit</i>.o=<i>organization</i></code>).</p>
■ Admin Password	The password for the Admin.
■ iManager PCO Password	<p>This is a unique password for iManager to use when logging in to eDirectory through LDAP as the Portal Container Object (PCO).</p> <p>Each instance of iManager that uses the same eDirectory tree must use the same PCO password.</p>
■ LDAP Server IP Address	The IP address of the LDAP server to which iManager users will authenticate.
■ LDAP Port	<p>The LDAP port through which iManager users will authenticate to the eDirectory server.</p> <p>The default value is 389.</p>
■ Secure LDAP Port	<p>The Secure LDAP port through which iManager users will authenticate to the eDirectory server.</p> <p>The default value is 636.</p>

**Table 2-5** *(continued)*

Component/ Data Required	Description
■ WebAdmin HTTP Port	<p>The HTTPS port number through which WebAdmin users administer NetMail and Red Carpet.</p> <p>This directive is included here because WebAdmin is accessed through iManager in NNLS.</p> <p>The default port is 8018.</p>
■ WebAdmin HTTPS Port	<p>The HTTPS port number through which WebAdmin users administer NetMail and Red Carpet.</p> <p>This directive is included here because WebAdmin is accessed through iManager in NNLS.</p> <p>The default port is 8020.</p>
<b>iPrint</b>	
■ Admin Name with Context	<p>The fully distinguished name of the Admin for the eDirectory server specified for iManager.</p> <p>The name and context must be specified using typeful syntax (<i>cn=name.ou=organizational-unit.o=organization</i>).</p>
■ Admin Password	The password for the Admin.
■ iPrint Server IP Address or Hostname	<p>The IP address or DNS hostname of the eDirectory server on which iPrint is installed and the schema is extended.</p> <p>The server must have a master or read/write replica of eDirectory installed.</p>
<b>Virtual Office</b>	

**Table 2-5** *(continued)*

<b>Component/ Data Required</b>	<b>Description</b>
■ eDirectory Server IP Address or Hostname	The IP address or DNS name of the eDirectory server on which Virtual Office is installed.  This server must have a master or read/write replica of eDirectory installed.
■ Admin Name with Context	The fully distinguished name of the Admin for the eDirectory server specified for iManager.  The name and context must be specified using typeful syntax ( <i>cn=name.ou=organizational-unit.o=organization</i> ).
■ Admin Password	The password for the Admin.
■ NetStorage Authentication Server	The IP address or DNS hostname of the eDirectory server to which NetStorage users authenticate using LDAP.
■ NetStorage Proxy User	The fully distinguished name of a user object with rights to do the following: <ul style="list-style-type: none"> <li>■ Search the LDAP (eDirectory) tree specified as the NetStorage Authentication Server for NetStorage users</li> <li>■ Store the iFolder user pass phrase in eDirectory the first time users access the storage location, if an iFolder storage location is defined in NetStorage</li> </ul>
■ NetStorage Proxy User Password	The password for the user specified as the NetStorage Proxy User.
■ NetStorage Users Context	The context on the NetStorage Authentication Server to be searched for NetStorage users.  (All sub-contexts are also searched.)

**Table 2-5** *(continued)*

<b>Component/ Data Required</b>	<b>Description</b>
<ul style="list-style-type: none"> <li>■ iFolder Server IP Address or Hostname</li> </ul>	(Optional) Specifies the IP address or hostname of the iFolder server you want created as a storage location in NetStorage. This makes iFolder automatically available to Virtual Office users.
<b>Red Carpet Client</b>	
<ul style="list-style-type: none"> <li>■ Admin E-Mail Address</li> </ul>	(Optional) The e-mail address through which you want to be notified about NNLS updates.
<ul style="list-style-type: none"> <li>■ Proxy Server (yes/no)</li> </ul>	Indicates whether the NNLS server connects to the Internet through a proxy server.
<ul style="list-style-type: none"> <li>■ Proxy Server Contact URL (if there is a proxy server)</li> </ul>	The URL that the NNLS server uses to communicate with its proxy server.
<ul style="list-style-type: none"> <li>■ Proxy User Name (if there is a proxy server)</li> </ul>	The username the NNLS server uses to authenticate with its proxy server.
<ul style="list-style-type: none"> <li>■ Proxy User Password (if there is a proxy server)</li> </ul>	The password for the proxy user.
<ul style="list-style-type: none"> <li>■ Internet Connection Required</li> </ul>	Without Internet connection available, the Red Carpet Client installation will fail. If this happens, establish Internet connectivity, uninstall the Red Carpet Client, and then reinstall it.



Dot delimitation is used for all installation parameters, described in Table 2-5, that involve eDirectory names and contexts. This is by design. Installation routines convert dots to commas for the components that require commas instead of dots.

However, during post-install administration and configuration of NNLS components, use the delimitation (dots or commas) that the documentation for each component specifies.

---

## The HOSTS File

Before you install NNLS, you must do the following to ensure proper resolution of the server's IP address by NNLS products:

1. Make sure the following line exists in the /etc/hosts file:

**127.0.0.1 localhost.localdomain localhost**

If the localhost entry contains the server's host name, the server's host name must be removed. For example, the localhost entry might look like this:

127.0.0.1 DA31 localhost.localdomain localhost

An entry like this example must have the server's host name removed.

2. Below the localhost line, add the following:

***serverip serverdns servername***

Where ***serverip*** is the IP address of your server, ***serverdns*** is the server's domain name, and ***servername*** is the hostname of your server.

For example, you might add the following:

**10.1.1.31 DA31.mycompany.com DA31**

## Multicast Routing

If you are installing NNLS into an existing eDirectory tree, the Linux host must be configured to support multicast routing. This is necessary so that the installation utility will be able to find the tree you are installing the Linux server into.

You also need to enable multicast routing if there are other trees that you need your server to be able to obtain services from.

To determine if the host is already enabled for multicast routing, enter the following command at the shell prompt:

**netstat -nr**

If multicasting has already been enabled, you should see a 224.0.0.0 0.0.0.0 entry in the routing table, as shown in the following:

Figure 2-9

```

student@DA4:~$ su -
Password:
DA4:~$ # netstat -nr
Kernel IP routing table
Destination        Gateway            Genmask           Flags   MSS Window  irtt  Iface
10.0.0.0            0.0.0.0            255.0.0.0         U        40  0        0    eth0
224.0.0.0           0.0.0.0            240.0.0.0         U        40  0        0    eth0
0.0.0.0            10.0.0.1           0.0.0.0           UG       40  0        0    eth0
DA4:~$ #
  
```

Point out that the **route -n** command can also be used.

If the 224.0.0.0 0.0.0.0 entry is not present, then multicasting must be enabled. To do this, complete the following:

1. Log in as root.
2. Enter the following command at the shell prompt:

**route add -net 224.0.0.0 netmask 240.0.0.0 dev *interface***

For example, if you have a typical Linux system with a single Ethernet network board, you would enter

**route add -net 224.0.0.0 netmask 240.0.0.0 dev eth0**





This command is not persistent. If you reboot the server, you must issue it again.

---

3. Enter **netstat -nr** at the shell prompt. Ensure the 224.0.0.0 0.0.0.0 entry is present as shown in Figure 2-9.

### ***How to Install NNLS***

To install NNLS on a Linux server, you need to know the following NNLS installation basics:

- Options for Installing NNLS
- How to Perform an Express or Custom Installation
- How to Perform an Unattended Installation
- How to Update the \$MANPATH Variable
- How to Check the Installation Log
- How to Recover From an Interrupted or Failed NNLS Installation

### **Options for Installing NNLS**

The following are options for installing NNLS:

- **Express.** You run the installation script and answer Yes to the question about an Express installation.

You need only supply the following basic information:

- Path to the NICI Foundation Key
- Tree Name (existing or new)
- Admin name with context
- Admin password

An Express installation does the following:

- ❑ Installs all NNLS product components on a single server.
- ❑ Creates a new eDirectory tree and Admin user in the context specified.
- ❑ Uses the Admin context as the eDirectory context for all other context parameters in the various products.
- ❑ Assigns the Admin password specified but does not save the password in the installation configuration file (nterprise\_linux\_services\_install.conf) created when the installation concludes.

For more information, see “How to Perform an Express or Custom Installation” on 2-37.

- **Custom.** You run the installation script and answer No (the default) to the question about an Express installation.

You will need to supply the information for all the components you have selected as indicated in Table 2-5.

A Custom installation does the following:

- ❑ Lets you specify exactly which components you want to install and ensures that the required supporting components (Apache, JVM, Tomcat, eDirectory) are also installed for the components you select.
- ❑ When you install eDirectory, choose one of the following:
  - ❑ A new eDirectory tree (with a new Admin user and password)
  - ❑ An existing eDirectory tree (authenticating as an existing Admin user)

You will perform a custom install in Exercise 2-1.

For more information, see “How to Perform an Unattended Installation” on 2-39.

- **Unattended Express.** You prepare an installation answer file prior to running the installation script. The answer file includes only basic information.

For more information, see “How to Perform an Unattended Installation” on 2-39.

- **Unattended.** You prepare an installation answer file prior to running the installation script. The answer file includes information on all NNLS product components.

For more information, see “How to Perform an Unattended Installation” on 2-39.

### How to Perform an Express or Custom Installation

To perform an express or custom installation, do the following:

1. Insert your *Novell Nterprise Linux Services (NNLS) 1.0* CD in the CDROM drive of your Linux server.
2. Open a terminal session and make sure you have superuser privileges by entering **su -** at the shell prompt, and entering the root password.
3. At a shell prompt, use the **cd** command to change to the `/media/cdrom` directory for SLES 8 (or the `/mnt/cdrom` directory for Red Hat) where the *NNLS 1.0* CD is mounted.
4. Start the installation by entering **./install.sh**.  
You are prompted to indicate if you want to install or uninstall NNLS.
5. Install NNLS by entering **i**.
6. If you want to do an Express installation, enter **y**; otherwise, press **Enter**.
7. Select the products you want to install using the options indicated on the screen.

8. Accept the license agreement.
9. When prompted for the location of the NICI Foundation Key file, mount the license diskette and enter ***the path*** to the NFK file.
10. Enter the information requested at each prompt (see Table 2-5).  
Each prompt includes a default value (such as [DA2-TREE]).  
You can accept the default value and continue by pressing Enter.
11. View the summary information by entering **y**.
12. (Conditional) If you need to change any information, enter **y** and follow the prompts to make your changes.
13. When you are ready to install, enter **f**.  
The installation program begins installing the services you selected.  
At the end of the installation, Apache and Tomcat are started.  
You are asked if you want to view the readme file.
14. View the readme file by entering **y**; then save the installation settings in a log file by entering **y**.
15. At the shell prompt, exit the superuser session by entering **exit**.
16. Close the terminal session window.
17. From your desktop, right-click the **NNLS** icon; then select **Unmount Volume**.
18. Remove the CD from your CDROM drive.

## How to Perform an Unattended Installation

The NNLS installation is designed to run unattended. This is a useful option for administrators who want to prepare an answer file with the required information rather than enter it at the shell prompt.

Novell provides 2 self-annotated template files you can customize and then use for performing unattended installations.

You can perform an unattended installation using either an express or custom installation.



---

Be sure to follow the instructions in the template files carefully to ensure that the installations will run correctly.

---

To perform an unattended installation, do the following:

1. Download the template answer file for the installation type you want to run:
  - **Express**  
<http://www.novell.com/documentation/lg/nnls/answers/express.txt>
  - **Custom**  
<http://www.novell.com/documentation/lg/nnls/answers/custom.txt>
2. Follow the instructions in the file to supply the information needed and place the file on your Linux server.
3. After the file is customized, run the installation script as instructed in the file.

## How to Update the \$MANPATH Variable

NNLS places some of its component specific man pages in a location that is not part of the default MANPATH. The files are placed in `/opt/novell/man`.

For example, the *smbpasswd* man page is placed in this path.



---

*smbpasswd* is explained in Section 6.

---

To update the \$MANPATH variable to include this location, enter the following command;

**export MANPATH=\$MANPATH:/opt/novell/man**

## How to Check the Installation Log

The NNLS installation logs all the events that occur during installation in the following location:

**`/var/log/nterprise_linux_services_install.log`**

Log files are in plain text and include the following:

- Error messages
- Warnings
- Progress at each step in the install
- User input
- System-related information
- Install-related values (for debugging) etc.

With this long filename, this is a good time to demonstrate the “tab complete” feature.

## How to Recover From an Interrupted or Failed NNLS Installation

During the information-gathering phase of the NNLS install, you can quit at any time by pressing Ctrl-C. This carries no repercussions and you can start the install process again at any time without performing any recovery steps.

However, once the installation has begun processing, configuring services, and copying files, an interruption or failure does have some repercussions.

To recover from a failed or interrupted installation, do the following:

1. (Conditional) If you were installing into an existing tree, use iManager to remove all eDirectory objects that were added to the tree before the install failed.
2. Whether installing into a new tree or an existing tree, run the NNLS uninstall option to remove the products that you tried to install.

You can also uninstall eDirectory without using the NNLS uninstall by entering **/usr/sbin/nds-uninstall** at a shell prompt.

3. Begin the NNLS install process again.

### ***How to Recover From a Failed Apache Process Start***

In rare cases, the Apache web service (novell-httpd) might not shut down properly when the NNLS server is shut down or rebooted.

When this happens, Apache creates a PID file that is used to track processes that are still running; this PID file might contain an *already running* value.

In these cases, when the server restarts, the PID file is read and falsely indicates that Apache is already running. The Apache service fails to start and you will encounter problems accessing iManager, iFolder, Virtual Office, and other components that use Apache.

If you suspect that Apache is not started, you can verify the problem by viewing the /var/log/boot.log file and searching for text strings similar to the following:

```
/etc/init.d/novell-httpd: Starting Apache:
/etc/init.d/novell-httpd: httpd (pid 1121) already
running
```

To resolve this issue, do the following:

1. Delete the **/var/opt/novell/httpd/run/httpd.pid** file.
2. Start Apache by entering **/etc/init.d/novell-httpd start**.



**45 minutes**

### ***Exercise 2-1    Install NNLS Services on Linux***

In this exercise you prepare your Linux server for an NNLS installation, and then install eDirectory 8.7.3 and all other NNLS services, adding your Linux server to DAX-TREE.



---

Remember that all Linux commands are case-sensitive.

---

All parts of this exercise must be completed in order for the rest of the exercises in this course to be completed.

Do the following:

- Part I: Configure Your Linux Server to Receive Time From DA1
- Part II: Verify the Hosts File Configuration
- Part III: Install NNLS Services on Your Linux Server
- Part IV: Test Your Installation

#### **Part I: Configure Your Linux Server to Receive Time From DA1**

As part of your requirements for providing a NNLS solution, you will be synchronizing data from your server to another NNLS server in the classroom. For the synchronization to work properly, you need to make sure your server time is synchronized to DA1.

To configure your Linux server to receive time from DA1, the time provider, do the following:

1. Make sure you have root privileges:
  - a. Open a terminal session.
  - b. At the shell prompt, enter **su -** and a password of **novell**.

Make sure students know what the timezone, and date and time are on DA1. It is best to have everyone do this step at the same time.

On the whiteboard, write the timezone as `tz=timezone`, and date and time in the format of `mmddhhmmYYYY` (which is month, day, hour, minute, year).

The hour must be based on the 24 hour clock.

For example, if the day is March 21, 2004 and the time is 2:45 PM, you would write the following:

**032114452004**

2. Adjust the system timezone and date and time properties on your Linux server to be within 2 minutes of the time and date on DA1.

Your instructor will write the timezone and the date and time for DA1 on the whiteboard and ask you to do the following with all other students at the same time:

- a. To adjust the timezone, enter **tzselect**; then follow the menu-driven prompts to select the correct timezone.
- b. To adjust the time and date, enter **date mmddhhmmYYYY** (where `mmddhhmmYYYY` is the month, day, hour (based on 24-hour clock), minute, and year).

For example, if the date is March 21, 2004 and the time is 2:45 PM, you would enter **date 032114452004**.

3. Adjust the time of your Linux server to be within seconds of the time on DA1 at the shell prompt by entering **ntpdate 10.0.0.1**.

Note the offset amount. This is the number of seconds that your time differs from that of DA1.

4. Repeat the command **ntpdate 10.0.0.1** until the offset is less than 5 seconds.

Leave the terminal session open as you continue on to the next few steps.

5. Select **Applications > KDE Menu > System > File Manager - Super User Mode**.
6. Enter a root password of **novell**; then select **OK**.
7. In the Location field, enter **/etc**.
8. Scroll down to and right-click **ntp.conf**; then select **Open With > KWrite**.

The first uncommented line is server 127.127.1.0.

9. Change this setting to the following:

**server 10.0.0.1**

10. Comment out the following line:

**# fudge**

11. Save the file by selecting **File > Save**; then exit by selecting **File > Close** (keep the KWrite window open).
12. From your terminal session at the shell prompt, enter the following commands to start the ntp service and set it to start on subsequent boots:

```
cd /etc/init.d  
./xntpd start  
chkconfig xntpd 35
```

13. View the configured time sources at the shell prompt by entering the following:

**ntpq -p**

You might have to wait a few moments for DA1's time source information to appear. The offset information that is displayed is in milliseconds.

You have now configured your Linux server to use DA1 as the time source.

## **Part II: Verify the Hosts File Configuration**

Verify that you have the correct entries in the hosts file by doing the following:

1. From KWrite, select **File > Open**; then browse to and open **/etc/hosts**.
2. Verify that you have a localhost entry that looks like the following:

**127.0.0.1 localhost**

3. Verify that you have an entry for your Linux server host name:

**10.0.0.x your server.your context.digitalairlines.com your server**

For example, if your IP address is 10.0.0.7 and your server is DA7 and your context is DEL, you should see

**10.0.0.7 DA7.del.digitalairlines.com DA7**

4. When you finish verifying, select **File > Quit**.
5. From the terminal session shell prompt, test the hosts file configuration by pinging *your domain name*.

For example, enter **ping da7.del.digitalairlines.com**

You should see that the domain name is resolved to the IP address of your server.

6. Stop the ping by pressing **Ctrl+C**.
7. (Conditional) If the ping test fails to resolve the domain name, restart network services by entering **rcnetwork restart**.

### Part III: Install NNLS Services on Your Linux Server

As you follow the installation instructions, use the following information to determine the tree name and organizational container (*your container*) that you need to enter:

**Table 2-6**

Server	Tree	Organization
DA3	DA3-TREE	o=ATL
DA4	DA4-TREE	o=BOI
DA5	DA5-TREE	o=BWI
DA6	DA6-TREE	o=DAY
DA7	DA7-TREE	o=DEL
DA8	DA8-TREE	o=DFW
DA9	DA9-TREE	o=GTF
DA10	DA10-TREE	o=IAD
DA11	DA11-TREE	o=IDA
DA12	DA12-TREE	o=LAX
DA13	DA13-TREE	o=LGA
DA14	DA14-TREE	o=LON
DA15	DA15-TREE	o=MCI
DA16	DA16-TREE	o=MEM
DA17	DA17-TREE	o=MIA
DA18	DA18-TREE	o=PDX
DA19	DA19-TREE	o=PHX
DA20	DA20-TREE	o=SYD
DA21	DA21-TREE	o=TXL
DA22	DA22-TREE	o=TYO

1. Copy the NICI Foundation Key file from the *3015 Course CD* to /tmp:
  - a. Insert the **3015 Course CD** in the CD drive of your Linux server.
  - b. Mount the CD by entering **mount /media/cdrom**.
  - c. From the shell prompt, change to the license folder on the CD entering **cd /media/cdrom/license**.
  - d. Enter **cp ./301789573.nfk /tmp**.
  - e. Enter **cd /root**.
  - f. Enter **umount /media/cdrom**; then remove the *3015 Course CD*.
2. Insert the *NNLS 1.0* CD into the CD drive of your Linux server.
3. Mount the CD by entering **mount /media/cdrom**.
4. At the shell prompt, make sure you are logged in as root by entering **whoami**.
5. Change to the CDROM directory by entering **cd /media/cdrom**.
6. Start the installation by entering **./install.sh**.

You are prompted to indicate if you want to install or uninstall NNLS.
7. Install NNLS by entering **i**.
8. Skip the Express installation by pressing **Enter**.

You are prompted to select the products you want to install. All products are currently selected (Yes).
9. (Optional) Verify component dependencies:
  - a. Deselect all products by entering **n**.
  - b. Select 1 component by entering the **number** of that component (i.e., the number for iFolder).
  - c. Note the other components that are automatically selected because they are required.

- d. Repeat steps a through c for as many individual components as you want.
  - e. When you are finished exploring, select all components by entering **a**.
- 10.** Leave all products selected and continue the installation by entering **f**.

A license agreement appears.

- 11.** Press the spacebar until you reach the end of the license agreement; then accept the agreement by entering **y**.
- 12.** From this point forward, you are prompted for information critical to installing the services you have selected.

Enter the correct information at each prompt. If a default entry appears with the prompt (such as [DA3-TREE]), you can accept the default (without typing) by pressing the Enter key.

The following table lists the information requested by each prompt and the correct data you need to enter:

**Table 2-7**

eDirectory

Information Requested	Data to Enter
NICI Foundation Key	<b>/tmp/301789573.nfk</b>
New Tree or Existing Tree	<b>1</b> (new tree)
New Tree Name	<b><i>your server-TREE</i></b> (see Table 2-6)
eDirectory Server Port	<b>524</b>
FDN Admin Name (with context)	<b>cn=admin.o=<i>your container</i></b> (see Table 2-6)
Admin Password	<b>novell</b> Enter twice (does not appear at the prompt)
Server Context	<b>o=<i>your container</i></b>
LDAP Port Number	<b>389</b>

**Table 2-7** *(continued)*

	Information Requested	Data to Enter
Linux User Management	Secure LDAP Port Number	<b>636</b>
	iMonitor HTTP Port Number	<b>8008</b>
	iMonitor HTTPS Port Number	<b>8010</b>
	LDAP Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	Admin Name with Context	<b>cn=admin.o=<i>your container</i></b>
	Admin Password	<b>novell</b>
	LDAP Port Number	<b>389</b>
	Secure LDAP Port Number	<b>636</b>
	Partition Root	<b>o=<i>your container</i></b>
	Workstation Context	<b>o=<i>your container</i></b>
DirXML	PAM-Enabled Services	<b>a</b> then <b>f</b> (to select all services)
	eDirectory Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	Admin Name with Context	<b>cn=admin.o=<i>your container</i></b>
	Admin Password	<b>novell</b>
eGuide	Secure LDAP Port	<b>636</b>
	LDAP Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	LDAP Port Number	<b>389</b>
	Secure LDAP Port Number	<b>636</b>
	Admin Name with Context	<b>cn=admin.o=<i>your container</i></b>
	Admin Password	<b>novell</b>



**Table 2-7** *(continued)*

	Information Requested	Data to Enter
Samba	eDirectory Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	Admin Name with Context	<b>cn=admin.o=</b> <i>your container</i>
	Admin Password	<b>novell</b>
	LDAP Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	Samba Proxy User	<b>cn=admin.o=</b> <i>your container</i>
	Samba Proxy User Password	<b>novell</b>
	LDAP Port Number	<b>389</b>
	Secure LDAP Port Number	<b>636</b>
	Remove Existing Samba Packages	<b>yes</b>
iFolder	LDAP Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	LDAP Port Number	<b>636</b>
	LDAP Admin Name with Context	<b>cn=admin.o=</b> <i>your container</i>
	LDAP Admin Password	<b>novell</b>
	iFolder Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	iFolder Admin Users	<b>admin</b>
NetMail	iFolder User Data Path	<b>/var/opt/novell/ifolderdata</b>
	Admin Name with Context	<b>cn=admin.o=</b> <i>your container</i>
	Admin Password	<b>novell</b>

**Table 2-7** *(continued)*

Make sure students do not miss the fact that their container name is part of the domain name for NetMail.

	Information Requested	Data to Enter
iManager	NetMail Primary DNS Server IP Address or DNS Name	<b>10.0.0.1</b>
	NetMail Secondary DNS Server	(leave blank)
	Domain Name for NetMail Server	<b><i>your container</i>.DigitalAirlines.com</b> <i>Do not</i> include the host name.
	NetMail WebAccess HTTP Port	<b>52080</b>
	NetMail WebAccess HTTPS Port	<b>52443</b>
	NetMail LDAP Port	<b>52389</b>
	iManager Server Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	Admin Name with Context	<b>cn=admin.o=<i>your container</i></b>
	Admin Password	<b>novell</b>
	eDirectory Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
iPrint	LDAP Port Number	<b>636</b>
	WebAdmin HTTP Port Number	<b>8018</b>
	WebAdmin HTTPS Port Number	<b>8020</b>
	eDirectory Tree Name	<b>DAx-Tree</b>
	Admin Name with Context	<b>cn=admin.o=<i>your container</i></b>
	Admin Password	<b>novell</b>

**Table 2-7** *(continued)*

	Information Requested	Data to Enter
Virtual Office	eDirectory Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	eDirectory Server IP Address or DNS Name	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	Admin Name with Context	<b>cn=admin.o=</b> <i>your container</i>
	Admin Password	<b>novell</b>
	NetStorage Authentication Domain Host	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	NetStorage Proxy User	<b>cn=admin.o=</b> <i>your container</i>
	NetStorage Proxy User Password	<b>novell</b>
	Users Context	<b>o=</b> <i>your container</i>
Red Carpet Client	iFolder Server Address	<b>10.0.0.x</b> or <b><i>server domain name</i></b>
	Email Address for Registration (optional)	<b>admin</b> <i>your container</i> @ <b>DigitalAirlines.com</b> (for example: <b>adminsyd@DigitalAirlines.com</b> )
	Connected to the Internet via a Proxy server?	<b>no</b>

After entering the Proxy server response, you are prompted to view the summary installation information.

- 13.** View the summary information by entering **y**.
- 14.** Scroll through the information; then do one of the following:
  - ❑ If you do not need to make any changes, enter **n**.
  - ❑ If you need to make changes, enter **y** and follow the prompts to make your changes.

The installation program begins installing and configuring the services you selected. An average installation time is 15 minutes.

At the end of the installation, Apache and Tomcat are started. You are asked if you want to view the readme file.

15. View the readme file by entering **y**; then save the installation settings in a log file by entering **y**.

You are returned to the shell prompt.

16. Make sure the CD is no longer in use by entering **cd /root**.

17. Enter **umount /media/cdrom**.

18. Remove the CD from your CDROM drive.

19. (Optional) View the install log file at **/var/log/nterprise\_linux\_services\_install.log**.

20. Exit the root session by entering **exit**.

21. Close the terminal session window.

#### Part IV: Test Your Installation

1. Verify that the components you installed are functioning correctly:
  - a. Start Mozilla by selecting the **Mozilla** icon from the top panel of your desktop.
  - b. To access Novell Nterprise Linux Services, enter **http://DAX.your\_container.digitalairlines.com**.  
This is your Novell Nterprise Linux server's home page.

- c. On the left you should see links for the following:
    - ❑ Virtual Office
    - ❑ NetMail
    - ❑ iFolder
    - ❑ eGuide
    - ❑ iManager
  - d. On the right you should see a link for the following:
    - ❑ Nterprise Linux Documentation
2. View your server object properties in iManager:
- a. From your Novell Nterprise Linux server's home page, select the **iManager** link.  
After a few moments, a Login page appears.  
(The iManager URL is **https://IP address or DNS Name/nps/iManager.**)
  - b. Log in as **admin** with a password of **novell**.  
After a few moments, the Novell iManager home page appears.
  - c. On the left under eDirectory Administration, select **Modify Object**.  
A Modify Object page appears.
  - d. On the right side of the Object name field, select the magnifying glass icon.  
A Browse Directory page appears.
  - e. Using the default settings, select **Browse**.
  - f. Browse to the contents of **your container** and select **your server** object.
  - g. Select **OK**.  
A properties page appears for your server.
  - h. Select the **Network address** field drop-down list; then view the network addresses and ports recognized by your server.

- i. From the categories drop-down list (at the top of the page), select other property pages and view the information.
  - j. When you finish, select **Cancel**.
3. Verify that eDirectory on your NNLS server is communicating properly by using iMonitor:
  - a. For the iMonitor URL, enter **https://DAX.your container.digitalairlines.com:8010**.  
A DHost HTTP Server page appears.
  - b. Select **NDS iMonitor**.  
A Login page appears.
  - c. Log in as **admin** with a password of **novell**.
  - d. (Conditional) If you are returned to the DHost HTTP Server page, select **NDS iMonitor**.  
After a few moments, the Novell iMonitor home page appears.
  - e. From the links at the left, select **Known Servers**.  
At the right, you see your server listed.
4. Close the Mozilla web browser.
5. Update the \$MANPATH variable to include the /opt/novell/man directory:
  - a. Open a terminal session.
  - b. At the shell prompt enter **man smbpasswd**.  
You should see a message stating that “No manual entry for smbpasswd.” The man page for smbpasswd, and other man pages specific to NNLS components, cannot be found without updating the \$MANPATH variable after NNLS is installed.
  - c. Enter **export MANPATH=\$MANPATH:/opt/novell/man**.
  - d. At the shell prompt enter **man smbpasswd**.  
Now you should see the man pages for smbpasswd.

- e. Close the terminal session.

***(End of Exercise)***

### ***Understand NNLS File and Data Locations***

Novell follows certain conventions when determining where to place NNLS files and data in the Linux file system. In general, NNLS components follow Linux Standards Base (LSB) requirements.

Where possible, the placement of NNLS files and data comply with the following rules:

- **/opt/novell.** This folder contains all static data, which is placed in the following standard subdirectories:
  - **/opt/novell/bin.** This folder contains executable files used by multiple products or can be executed by a user.
  - **/opt/novell/product/bin.** This folder contains executable files that are used only by a product (not by users).
  - **/opt/novell/lib.** This folder contains shared libraries used by multiple products and contains shared or static libraries that are part of an SDK.
  - **/opt/novell/include.** This folder contains header files for SDKs (typically in a product subdirectory).
- **/etc/opt/novell.** This folder contains host-specific configuration data. Product configuration files are generally named *product.conf*. They are placed in a subdirectory named for the product. For example, */etc/opt/novell/netstorage* contains the *netstorage.conf* file.

Some products have a more complex structure, for example the */etc/opt/novell/httpd* directory contains a *conf* folder with several *conf* files in it.



---

The eDirectory configuration file is `/etc/nds.conf`.

---

- **`/var/opt/novell`**. This folder contains all variable data.

Variable data (data that changes during normal run time operations) is stored in a product subdirectory. For example, iFolder user data, including account information and synchronized files, is stored in `/var/opt/novell/ifolderdata`.

- **`/var/opt/novell/log`**. This folder generally contains product log files. If a product has a single log file, it is stored in a file with the product name.

If a product has multiple log files, they are stored in a subdirectory named for the product.



---

The eDirectory log file is `/var/nds/ndsd.log`.

---

Most files and directories that do not follow the first 4 rules have the prefix *novell*- so they can be more easily identified. For example, init scripts must reside in `/etc/init.d` and cron scripts in `/etc/cron.d`.

To find NNLS files stored in `/etc/init.d`, enter the following command:

**`ls /etc/init.d/novell*`**

You should see several files, including the following:

- `novell-httpd`
- `novell-tomcat4`
- `novell-netmail`
- `novell-smb`



Files for some components cannot use the *novell-* prefix. For example, in the case of PAM modules, standards require the use of suffixes instead of prefixes (for example, */lib/security/pam\_nam.so*).

### ***How to Uninstall NNLS Components***

To uninstall NNLS components, do the following:

1. Insert your *Novell Nterprise Linux Services (NNLS) 1.0* CD in the CDROM drive of your Linux server.
2. Open a terminal session and make sure you have root privileges by entering **su -** at the shell prompt, and entering the root password.
3. At a shell prompt, use the **cd** command to change to the **/media/cdrom** directory for SLES 8 (or the **/mnt/cdrom** directory for Red Hat) where the *NNLS 1.0* CD is mounted.
4. Start the installation by entering **./install.sh**.

You are prompted to indicate if you want to install or uninstall.

5. To uninstall NNLS components, enter **u**.

You are presented with a menu of NNLS components. All of them are set to *no*.

6. Before removing any component, check for dependencies.
7. For each component you want to uninstall, toggle the selection status to *yes* by entering the number corresponding to the component.

For example, to uninstall iPrint, enter 12 and the selection will change to *yes* for iPrint.

To remove all components, select **a** for all.

8. Enter **f** when you are finished making selections.
9. Wait while the NNLS install script stops the service and removes it from the server.

10. Restart Apache and Tomcat by entering the following commands at the shell prompt:

```
/etc/init.d/novell-httpd restart  
/etc/init.d/novell-tomcat4 restart
```

### ***Install NNLS Components After Initial Installation***

You can run `install.sh` to install NNLS components that you did not install at initial installation. The steps are essentially the same as those found above in “How to Perform an Express or Custom Installation” on 2-37.

The difference is that some components are already installed. These will be indicated with an *already installed* flag on the menu of NNLS components.

An additional step is also required that was not part of the initial installation. After the additional components are installed, you must restart Apache and Tomcat.

You do this by entering the following commands at the shell prompt:

```
/etc/init.d/novell-httpd restart  
/etc/init.d/novell-tomcat4 restart
```

### ***How to Configure SLP on Your Linux Server***

If your server is part of a network that has a Directory Agent configured, you need to make SLP configuration changes, after installing NNLS on your Linux server.

On IP networks, the Service Location Protocol (SLP) provides the dynamic discovery of services.

The term *service* is used when talking about SLP. In this context, services are applications running on a host (server or client) that other hosts on the network can access.

When a NetWare server starts up, these services (applications) register themselves with SLP and make themselves available to the network.

From a high-level viewpoint, the information that SLP maintains about a service is simply the service name and the IP address of the host (normally a server) that is running this service.

Novell provides a basic level of SLP v1 support with eDirectory for Linux.

To configure SLP on Linux, you need to know the following:

- User Agents and Service Agents
- How to Stop and Start the SLP Daemon Process
- eDirectory Interoperability with OpenSLP on Linux

### **User Agents and Service Agents**

By default, the NNLS installation configures the Novell slpuasa daemon to provide the functionality for both the User Agent and the Service Agent.

If you need to configure the SLP configuration (i.e., to use a directory agent), edit the slpuasa.conf file to specify new parameters and values, and then restart the slpuasa daemon.

The /etc/slpuasa.conf file contains a list of configuration parameters for configuring the SLP User Agent - Service Agent daemon.

The slpuasa daemon reads this file when it is started. If any change is made to the slpuasa.conf file, the daemon needs to be restarted for the changes to be effective.

Each parameter in the slpuasa.conf file is in a single line in the form, as follows:

***parameter=value***

The parameters are described in the following table:

**Table 2-8**

Parameter	Description
DA_ADDR	A list of IP addresses and scopes of SLP Directory Agents to statically configure the User Agent/Service Agent, in the format <unscoped_da_ip_addr1>, <unscoped_da_ip_addr2>,... <unscoped_da_ip_addrn>, (<scoped_da_ip_addr1>, <list_of_da_scopes>), (<scoped_da_ip_addr2>, <list_of_da_scopes>),... (<scoped_da_ip_addrn>, <list_of_da_scopes>).
net.slp.isBroadcastOnly	Lets you select broadcast or multicast SLP requests.  A value of 0 means the User Agent and Service Agent use multicast. A value of 1 means they use broadcast.  Default = 0.

**Table 2-8** *(continued)*

Parameter	Description
net.slp.isMulticastOnly	<p>Use this option only if you have problems because of a Directory Agent, because this parameter can cause an unnecessary increase in the multicast traffic in the network.</p> <p>A value of 1 means that the slpuasa daemon will not discover any Directory Agents (active or passive).</p> <p>Default = 0.</p>
net.slp.MTU	<p>The Maximum Path Unit to be set parameter is used by the Service Agent to service the SLP requests.</p> <p>Default = 1400</p>
net.slp.MulticastRadiu	<p>The site's multicast TTL.</p> <p>Default = 32.</p>

The daemon will read the `/etc/slpuasa.conf` file on startup and perform an Active-Discovery of the Directory Agent on the network if the MulticastOnly option is disabled or commented out (the default value is 0).

Otherwise, the daemon will use the multicast option.

#### How to Stop and Start the SLP Daemon Process

The slpuasa can be started and stopped with the slpuasa script. The format is as follows:

```
/etc/init.d/slpuasa {start/stop}
```

**eDirectory Interoperability with OpenSLP on Linux**

Novell SLP v1 is now an optional package. In fact, Novell recommends using a third-party SLP solution, such as OpenSLP, if a more robust SLP solution is needed.

If OpenSLP RPMs are already installed on Linux, the eDirectory installation will skip the Novell SLP installation. eDirectory uses the platform-specific SLP APIs by default.



---

For additional information on OpenSLP, see <http://www.openslp.org/>

---

**Objective 3      Manage NNLS with Red Carpet**

Red Carpet is a program designed to help you manage the software you have on your Linux servers by installing, updating, and removing programs. Any dependencies or conflicts are handled by Red Carpet.

Red Carpet uses packages and channels to organize software, the Red Carpet Daemon (RCD) to perform updates, installations, and removals of software, and the rug command line interface and iManager to control the RCDs.

To manage your NNLS products with Red Carpet, you need to know the following:

- Red Carpet NNLS Components
- How to Manage RCD Groups with iManager
- How to Manage NNLS Products with iManager
- How Red Carpet Is Implemented in NNLS

## ***Red Carpet NNLS Components***

The following components enable NNLS product updating with Red Carpet:

- Packages
- Channels
- RCD
- rug Command Line Interface
- iManager Plugins

### **Packages**

Software for most versions of Linux is shipped as a package file, most commonly the Red Hat Package Manager (rpm) or Debian (deb) format.

Each package contains a set of files that constitute the software itself, plus additional information about what the software is, what requirements it has, and where it should be installed.

### **Channels**

Red Carpet groups software packages into channels. For example, “NNLS,” “Red Hat Linux 9,” and “Ximian Desktop” are all channels.

You can subscribe to channels that interest you and ignore those that do not.



---

Novell currently only provides 1 channel with NNLS that you can subscribe to - the NNLS channel.

---

## RCD

The Red Carpet Daemon is the workhorse of Red Carpet. It is used to perform the installations, updates, and removals of software on your Linux servers.

The RCD is automatically installed on every Linux server that receives an NNLS installation.

## rug Command Line Interface

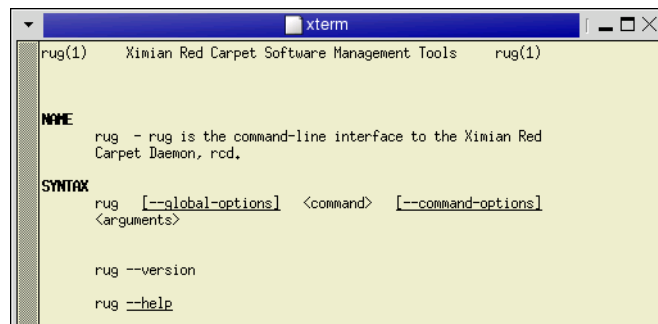
The rug command line interface can be used to manage the RCD on 1 Linux server at a time. To use rug to manage a Linux server, you must be physically at that server.



Detailed information about rug and RCD are available in their man pages (standard UNIX manuals). To view the man pages for rug or for the RCD, enter **man rug** or **man rcd** at the command line in a terminal session.

The following is part of the man rug document:

Figure 2-10



```
rug(1)      Xinian Red Carpet Software Management Tools      rug(1)

NAME
rug - rug is the command-line interface to the Xinian Red
Carpet Daemon, rcd.

SYNOPSIS
rug [--global-options] <command> [--command-options]
<arguments>

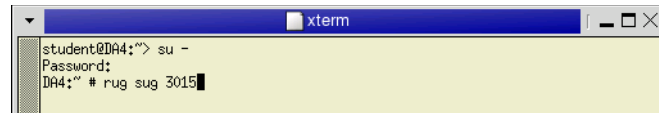
rug --version

rug --help
```



The following is an example rug command:

**Figure 2-11**



## iManager Plugins

The RCD plugins for iManager let you perform tasks such as creating RCD groups and configuring NNLS products for updating from Novell's one-stop web-enabled management tool.

### *How to Manage RCD Groups with iManager*

iManager can be used to manage the RCD on a single Linux server, but it can also be used to create RCD groups and to manage those groups from a single location simultaneously.

Because of iManager's capability to manage multiple RCDs from a single location at one time, this course will teach you how to manage your NNLS software using Red Carpet with iManager.

Before you can manage RCD groups with iManager, you must do the following:

- Create an RCD Group Object
- Modify the RCD Group Object

### Create an RCD Group Object

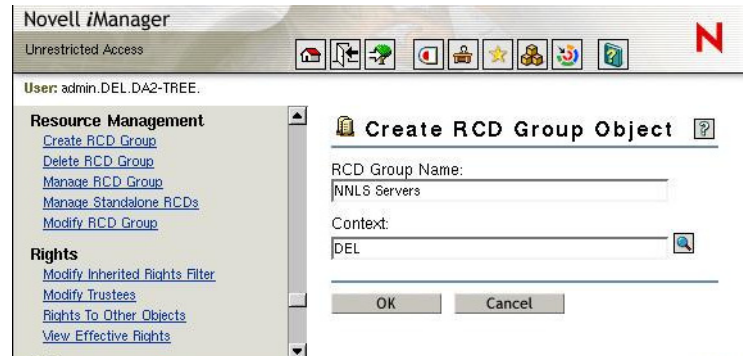
When you create an RCD Group Object, you are in essence creating an eDirectory group object and assigning it a name.

To create an RCD Group Object, you must do the following:

Point out that you could manage 1 or more servers with the Manage Standalone RCD's selection, but that the list of servers the user creates to manage is not saved in eDirectory, and needs to be re-entered the next time the user wants to manage that group of servers.

1. Open iManager.
2. At the left under Resource Management, select **Create RCD Group**.

Figure 2-12



3. Enter a name for the RCD Group Object.
4. Enter a context for the RCD Group Object.  
An RCD Group Object can reside anywhere in your tree.
5. Select **OK**.

### Modify the RCD Group Object

When you modify the RCD Group Object, you group together all of the Linux servers that have an RCD running on them.

To modify an RCD Group Object, do the following:

1. In iManager under Resource Management, select **Modify RCD Group**.
2. Browse to and select an RCD Group Object.
3. Select **OK**.

This is where you add devices to your RCD Group Object (you can also edit and delete them from this location as well).

Under the User List you can add users to help you manage your RCD groups. You can assign users Read rights or Full rights, depending upon the type of access you want to grant them.

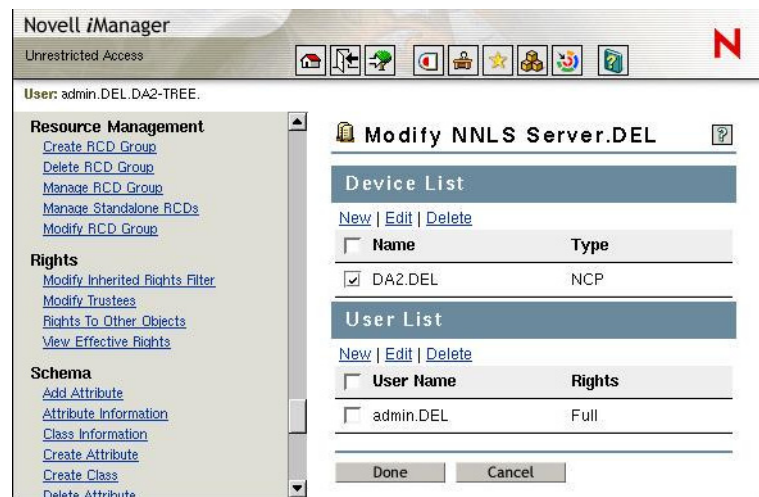
4. Under Device List, select **New**.
5. Select **NCP Server**.

An NCP server is a Linux server with the RCD running on it. If your Linux server does not exist in your eDirectory tree as an NCP server, you would select Red Carpet Daemon.

6. Select **OK**.

7. Browse to and select the NCP Server you want to include within the current RCD Group.

Figure 2-13



8. Select **OK**.
9. Repeat steps 4 through 8 for as many devices as you would like to add to this RCD Group.
10. Select **Done**.

### ***How to Manage NNLS Products with iManager***

To manage NNLS products with iManager, do the following:

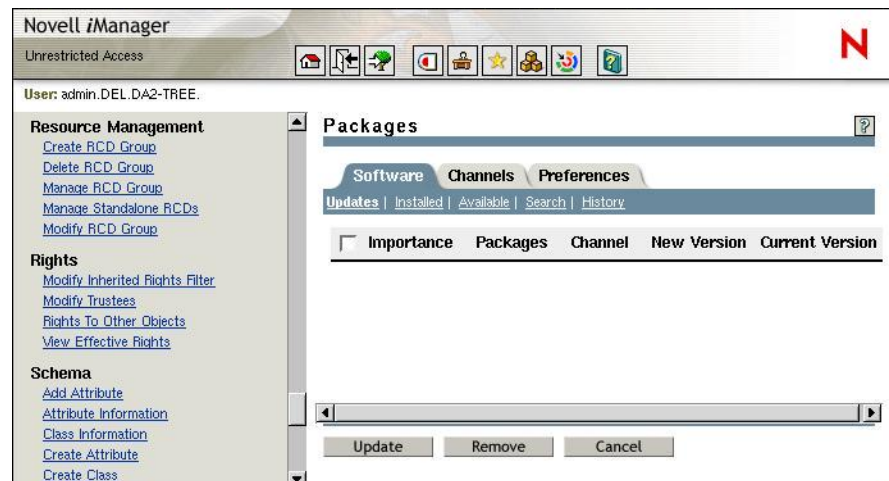
1. In iManager under Resource Management, select **Manage RCD Group**.
2. Browse to and select an RCD Group Object.
3. Select **Get Devices**.

This displays all of the devices in this RCD Group Object along with their type and current status.

4. Select 1 or more devices from the list that you want to manage. Each selected device must use the same host server.
5. Select **OK**.

This opens the Packages frame where you can now manage the NNLS updates on your Linux servers.

**Figure 2-14**



The following tabs are found in the Packages frame:

- Software-Updates
- Software-Installed
- Software-Available
- Software-Search
- Software-History
- Channels-View Channels
- Preferences-General
- Preferences-Cache
- Preferences-Advanced
- Preferences-Activate

## Software-Updates

The Software-Updates tab displays available updates to software packages you have installed. Updates are displayed if a package is installed on 1 or more of the servers you have selected to manage, and if the update is in a channel to which you are subscribed.

The Importance column indicates how important it is for you to install this update. From least to most important, an update can be listed as minor, feature, suggested, urgent, or necessary.

The Package column lists the name of the package for which there is an update. Click the package name for additional package information.

The Channel column lists the name of the channel in which this package is shipped.

The New Version column lists version number for the updated package. Note that version numbers do not count by digits, but instead use numbers separated by periods. In other words, version 1.10 is newer than version 1.9. You can remember this by referring to “one point ten” instead of “one point one zero.”

The Current Version column lists the version number of the package you have installed.

To update the software packages on the group of Linux servers currently in your RCD Group, do the following:

1. Select the boxes of the updates you want to apply.
2. Select **Update**.

### Software-Installed

The Software-Installed tab displays packages installed on 1 or more of the servers you have selected to manage.

To remove software packages from the group of Linux servers currently in your RCD Group, do the following:

1. Select the boxes of the packages you want to remove.
2. Select **Remove**.

### Software-Available

The Software-Available tab displays packages available for installation on each of the servers you have selected to manage.

To install software packages on the group of Linux servers currently in your RCD Group, do the following:

1. Select the boxes of the packages you want to install.
2. Select **Install**.

### Software-Search

The Software-Search tab enables you to find a broad range of available packages in any channel.

### Software-History

The Software-History tab displays a list of your past transactions. Each time you install, remove, or upgrade a piece of software, it is recorded here.

## Channels-View Channels

The Channels-View Channels tab displays all available channels. You can use this tab to select the channels you want to check for updates or new packages.

The Mount Channel command enables you to mount a directory on the file system as a channel.

The Unmount channel command enables you to unmount a directory on the file system as a channel.

## Preferences-General

The Server URL is the location of the Red Carpet server you are using. If you know the exact URL of a server, you can enter it here and subscribe to channels from another server.



---

Novell does not recommend that you change this URL. You need to be pointing to this URL in order to receive NNLS updates on your system.

---

The following are available options:

- **Enable Premium Services.** If you have already activated Red Carpet Express or Red Carpet Enterprise services, you can turn them on and off here.

Novell ships the Red Carpet package with a cryptographic signature. Unless you absolutely trust your server, you should leave this enabled.

- **Maximum Number of Packages to Download at Once.** If possible, Red Carpet downloads several packages at once in order to make the best use of your network connection. If you have a very fast connection, you might want to increase this number.



- **Use a proxy.** If your network uses an HTTP proxy, check this box; then enter the proxy URL. If necessary, also enter your username and password.

### **Preferences-Cache**

Red Carpet stores downloaded files in a cache. If you quit or cancel an operation, you can resume it quickly without re-downloading. If you don't want to cache anything, deselect this option. It is enabled by default.

The cache can be automatically emptied after a certain number of days, or once it exceeds a certain size.

### **Preferences-Advanced**

This tab allows you to make advanced configurations such as the interval at which the server data is refreshed, and the level at which log files are written (a value of 1 sends the most important, 6 sends every message, and 0 sends no messages).

You can select the Use HTTP/1.0 option if your proxy or server insists on strict HTTP/1.0 protocol for communications.

### **Preferences-Activate**

If you purchase a subscription to the Red Carpet Express premium service, you will use this tab to activate your subscription.

### ***How Red Carpet Is Implemented in NNLS***

The NNLS installation includes the required RCD component. The RCD is preconfigured to connect to the Red Carpet Enterprise server and channel that are hosted by Novell.

All updates to NNLS components can be obtained through RCD. The process described under “How to Manage RCD Groups with iManager” on 2-67 outline the configuration process you must use to receive these updates.



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For Course 3015 purposes only, you will not use the RCE server hosted by Novell. Exercise 2-2 enables you to use the RCE server that is set up in your classroom.

---

**10 minutes**

## ***Exercise 2-2 Use Red Carpet to Update Your NNLS Installation***

This exercise must be completed in order for the NetStorage exercise to work correctly.

Make sure the activation key is written on the board for students to use in this step of the exercise.

The Red Carpet Daemon that is installed with NNLS is preconfigured to get updates from the RCE server at Novell. To get your updates from the server in the classroom, do the following:

1. Change the RCD default settings:
  - a. At a shell prompt, log in as root by entering **su -** and a password of **novell**.
  - b. Reset the RCE host setting by entering the following command:  
**rug set host https://10.0.0.1/data**  
You should see a message stating that your host has been changed.
  - c. Activate your group membership by entering the following:  
(See your instructor for the activation key number.)  
**rug activate activationkey admin@  
your.container.digitalairlines.com**  
For example, your entry might look like this  
**rug activate 4dec-2f02-40ad-9c01 admin@  
del.digitalairlines.com**
  - d. View the channels now available to you by entering **rug ch**.

2. Subscribe to the 3015 channel and perform an update:
  - a. At the shell prompt, enter **rug sub 3015**.
  - b. View the list of available updates by entering **rug lu**.  
You should see the novell-netstorage update. The table also shows the current version number and the update version number.
  - c. (Conditional) If you do not see any updates listed, enter **rug refresh**; then enter **rug lu** again.
  - d. Begin the update by entering **rug update**.
  - e. When asked if you want to continue, select **y**.  
The updates are downloaded and installed.
3. When the transaction is finished, enter **exit**; then close the terminal session window.

*(End of Exercise)*

## Summary

Objective	Summary
1. Describe Novell Nterprise Linux Services (NNLS)	<p>Novell Nterprise Linux Services (NNLS) v1.0 lets you take advantage of the open-source benefits of Linux combined with the powerful set of enterprise services previously only available on NetWare, including the following:</p> <ul style="list-style-type: none"><li>■ Identity Services</li><li>■ Personal File Management Services</li><li>■ Print Services</li><li>■ Messaging and Calendaring Services</li><li>■ Web Experience</li><li>■ Resource Management Services</li><li>■ Web-Based Administration</li></ul> <p>NNLS v1.0 is ideal for early adopters of Linux and runs on the following Linux enterprise versions:</p> <ul style="list-style-type: none"><li>■ SLES 8</li><li>■ Red Hat Enterprise Linux AS 2.1</li><li>■ Red Hat Enterprise Linux ES 2.1</li></ul>

Objective	Summary
<b>2. Perform an NNLS Installation</b>	<p>To install the components of NNLS, you need to know the following:</p> <ul style="list-style-type: none"><li>■ How to Obtain NNLS Software and Licenses</li><li>■ How to Prepare for an NNLS Installation</li><li>■ How to Install NNLS</li><li>■ How to Configure SLP on Your Linux Server</li></ul>

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Objective	Summary
<b>3. Manage NNLS with Red Carpet</b>	<p>Red Carpet is a program designed to help you manage the software you have on your Linux servers by installing, updating, and removing programs. Any dependencies or conflicts are handled by Red Carpet.</p> <p>Red Carpet uses packages and channels to organize software, the Red Carpet Daemon (RCD) to perform updates, installations, and removals of software, and the rug command line interface and iManager to control the RCDs.</p> <p>To manage your NNLS products with Red Carpet, you need to know the following:</p> <ul style="list-style-type: none"><li>■ Red Carpet NNLS Components</li><li>■ How to Manage RCD Groups with iManager</li><li>■ How to Manage NNLS Products with iManager</li></ul>

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## SECTION 3 Provide Directory Services with eDirectory

This section is intended as a **review** of eDirectory fundamentals and an overview of eDirectory and Linux.

You should be familiar enough with this section and your students' eDirectory skills to determine which parts of this section you need to teach.

If students are familiar with eDirectory (such as a CNA or CNE<sup>SM</sup>), skip the eDirectory fundamentals, review the Linux-specific material, and make sure students perform the exercises to become familiar with using eDirectory tools in a Linux environment.

In this section you learn the fundamentals necessary to understand how Novell® eDirectory™ provides directory services for the products contained in Novell® Nterprise™ Linux® Services.

### Objectives

1. Describe the Purpose of eDirectory
2. Describe How eDirectory Works
3. Perform eDirectory Administration Tasks

### Introduction

eDirectory is a fundamental component of Novell Nterprise Linux Services (NNLS).

Before you can understand how NNLS works and how to configure many of the NNLS components for a lab or production environment, you need to understand the purpose of eDirectory, how eDirectory works, and how to perform some basic eDirectory administrative tasks.

## Objective 1      Describe the Purpose of eDirectory

The directory services provided by eDirectory in NNLS strengthen enterprise security and decrease management costs of cross-platform business solutions.

To describe the purpose of eDirectory, you need to know the following:

- What a Full-Service Directory Provides
- The Role of eDirectory

### ***What a Full-Service Directory Provides***

A full-service Directory is a database that provides features such as discovery, security, storage, and relationship management.

You typically use a full-service Directory in the following ways:

- **To organize data.** A Directory service is an organized listing of data or information.  
  
For example, eDirectory stores information about users, servers, printers, and other network devices. This helps network administrators perform their job better.
- **To more easily provide access to information.** A Directory service makes information about network resources available to users, devices, or applications.

A Directory service most people are familiar with is the telephone book. This provides an easy way to store, organize, and search for telephone numbers and addresses of people and businesses in your community.

Businesses use Directory services to provide employees with global access to network resources.

Organizations also use Directory services to provide user authentication to network resources, and authorize them to access specific network resources and services.

NNLS applications (such as Novell iFolder®) that need access to user information use eDirectory to store this user information. These applications are called *Directory-enabled*.

- **To provide security.** A Directory service is helpful to administrators because it
  - Identifies network resources precisely and uniquely
  - Searches for and locates network objects when required
  - Supports robust security features
  - Controls user access to network resources

This helps network administrators perform their jobs better.

- **To provide services to customers.** Hospitals, e-businesses, and various other industries are now using Directory services to provide effective services to customers.

The power of the Directory service helps businesses lay the foundation for e-business by

- Putting their multiple databases in order
- Simplifying disparate networks
- Allowing better management of processes between customers, employees, and supply chain partners

A Directory service offers businesses many advantages, including

- Reduced network administration and hardware costs
- Faster access to data and information
- Secure network access and superior fault tolerance

The number of Directory-based applications is rapidly increasing. Many provide crucial e-business functionality such as automated business-relationship management, supply-chain management, and electronic storefronts.

Other services provided by Directory-enabled products include automated provisioning, enhanced security, customer profiling, electronic wallets, automated notification systems, customized web interfaces, and virtual private networks (VPNs).

### ***The Role of eDirectory***

The role of eDirectory is to provide the basic foundation for Directory services. This foundation provides replication and partitioning capabilities, along with other utilities, and the following benefits:

- Central management of network information, resources, and services
- A standard method of managing, viewing, and accessing network information, resources, and services
- A logical organization of network resources that is independent of the physical characteristics or layout of the network
- Dynamic mapping between an object and the physical resource it refers to

The products provided in NNLS build upon this basic directory structure, increasing the importance and effectiveness of eDirectory in providing an Nterprise Directory services solution.

## Objective 2      Describe How eDirectory Works

To describe how eDirectory works, you need to know the following about eDirectory:

- eDirectory Tree Architecture
- How eDirectory Uses Foundation Services
- eDirectory and LDAP

### ***eDirectory Tree Architecture***

The eDirectory tree is a hierarchical structure that stores and organizes objects. It includes the tree object and container objects.

The eDirectory tree lets you view the logical organization of network resources in the Directory database.

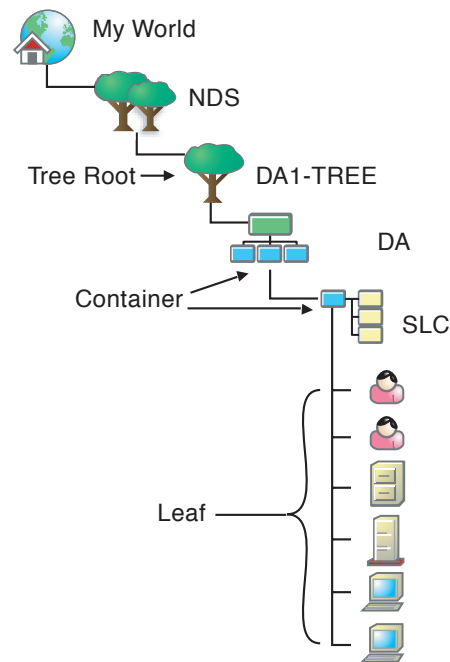
The eDirectory tree structure is similar to the tree structure found in the DOS file system.

The top of the tree is called the *tree object*. *Container objects*, like folders in a file system, are placed in the tree object or in other containers. (A container object is called a *parent object* if it contains other objects.)

*Leaf objects*, like files store in folders, are placed within containers.

The following shows a sample eDirectory tree structure for Digital Airlines:

**Figure 3-1**



While it is recommended that most networks have only 1 Directory and 1 eDirectory tree, some enterprise network solutions use more than 1 eDirectory tree.

For example, a network might have 1 eDirectory tree for storing all application and system information, and use a second eDirectory tree for user authentication purposes.

However, you need to remember when using multiple trees that each tree is separate and independent from other trees in the network and maintains its own database.



One way of sharing and synchronizing data between trees is to use DirXML® technology (discussed in Section 5).

Each class of container object has different rules that define what it can contain and where it can be located in the eDirectory tree. Each class also has different properties.

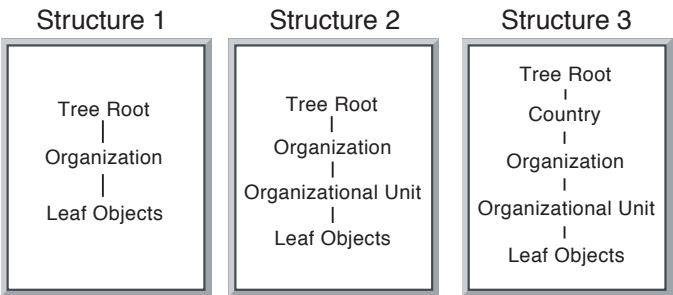
The following lists the distinguishing characteristics of each type of container object:

Table 3-1

Container Objects	Can Exist In	Can Contain	Example
Country	Tree	Organization	US
		Alias	FR
Organization	Tree	Organizational Unit	Novell
	Country	All leaf objects	UCLA
Organizational Unit	Organization	Organizational Unit	Marketing
	Organizational Unit	All leaf objects	Flightops

The following illustrates 3 possible eDirectory tree structures:

Figure 3-2



Container restrictions lead to the following hierarchical tree structure requirements:

- The tree object must be at the top.
- Country and organization objects are in the tree object.
- Organization objects are in country objects.
- Organizational unit objects are in organization objects or in other organizational unit objects.

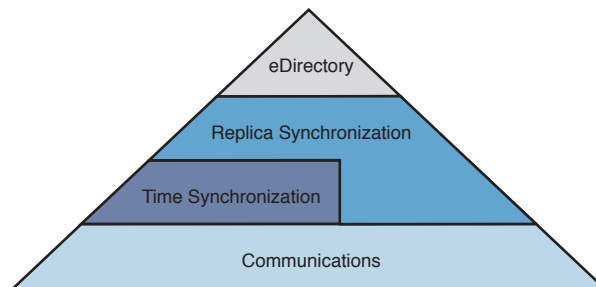


For more on the eDirectory tree, search for *tree structure* in the online documentation at [www.novell.com/documentation](http://www.novell.com/documentation).

---

### ***How eDirectory Uses Foundation Services***

eDirectory relies on a foundation of error free communications, accurate time synchronization, and efficient replica synchronization, as illustrated in the following:



**Figure 3-3**



In previous versions of eDirectory, Replica Sync would not function without time being synchronized.

Replica synchronization is now more robust and better at maintaining consistency while time synchronization is being re-established.

However, if time is not synchronized, Replica synchronization might yield unexpected results.

Time synchronization and replica synchronization depend upon a foundation of solid communications. Without solid communications, these services cannot function well.

Although replica synchronization operates independently of time synchronization, it relies on accurate time stamps to make sure that replicas are synchronized properly. Without accurate time synchronization, unexpected results can occur.

With the foundation services in place and functioning properly, eDirectory and its background process are able to function smoothly and efficiently. Without them, eDirectory will not be able to function at its best and might not function at all.

To understand how these foundation services help keeping eDirectory running smoothly, you need to know the following:

- SLP and eDirectory
- Time Synchronization and eDirectory
- Partitions and Replication in eDirectory

In addition, you should also understand the following to effectively utilize eDirectory in a Linux environment:

- Transport Layer Security (TLS)

## **SLP and eDirectory**

On IP networks, the Service Location Protocol (SLP) provides the dynamic discovery and communication of services.

Discovery of network services is essential to eDirectory operation. In addition, services such as eDirectory can contain a rich set of attributes that clients and applications can use to identify services that meet their needs.

Through Novell's integration of SLP with eDirectory, local SLP information is compiled to provide a global representation of all available services on the network. This provides dynamic discovery of services locally and scalability in large networks.



---

eDirectory does **not** rely directly upon SLP for discovery of services on the network. eDirectory uses its own Directory information as the primary means for discovery of network services.

However, client discovery of the tree and verification of network addresses does rely upon SLP to locate needed services on the network. In addition, client requests using NWDS APIs use SLP, but client requests through LDAP do *not* use SLP.

---

Novell provides a basic level of SLP v1 support with eDirectory for Linux® (SLP v2 on NetWare®) as described by the following:

- **User Agents and Service Agents.** The Novell slpuasa daemon provides the functionality for both the User Agent and the Service Agent.

To configure the agents, you edit the slpuasa.conf file to specify configuration information and then run the slpuasa daemon.

The /etc/slpuasa.conf file contains a list of configuration parameters for configuring the SLP User Agent - Service Agent daemon.

The slpuasa daemon reads this file when it is started. If any change is made to the slpuasa.conf file, the daemon needs to be restarted for the changes to be effective.

Each parameter in the slpuasa.conf file is in a single line in the form, as follows:

***parameter=value***

The parameters are described in following table:

**Table 3-2**

Parameter	Description
DA_ADDR	A list of IP addresses and scopes of SLP Directory Agents to statically configure the User Agent/Service Agent, in the format <unscoped_da_ip_addr1>, <unscoped_da_ip_addr2>,... <unscoped_da_ip_addrn>, (<scoped_da_ip_addr1>, <list_of_da_scopes>), (<scoped_da_ip_addr2>, <list_of_da_scopes>),... (<scoped_da_ip_addrn>, <list_of_da_scopes>).
net.slp.isBroadcastOnly	Lets you to select either broadcast or multicast SLP requests.  A value of 0 means the User Agent and Service Agent use multicast. A value of 1 means they use broadcast.  Default = 0
net.slp.isMulticastOnly	Use this option only if you have problems because of a Directory Agent, because this parameter can cause an unnecessary increase in the multicast traffic in the network.  A value of 1 means that the slpuasa daemon will not discover any Directory Agents (active or passive).  Default = 0

**Table 3-2** (continued)

Parameter	Description
net.slp.MTU	The Maximum Path Unit to be set parameter is used by the Service Agent to service the SLP requests. Default = 1400
net.slp.MulticastRadiu	The site's multicast TTL. Default = 32

The daemon will read the `/etc/slpua.conf` file on startup and perform an Active-Discovery of the Directory Agent on the network if the `isMulticastOnly` option is disabled or commented out (the default value is 0).

Otherwise, the daemon will use the multicast option.

- **Starting and stopping the daemon process.** The `slpuasa` can be started and stopped with the `slpuasa` script.

Enter the following for SuSE® distributions:

**`/etc/init.d/slpuaasa {start/stop}`**

Enter the following for Red Hat® distributions:

**`/etc/rc.d/init.d/slpuaasa {start/stop}`**

- **SLP and tree names.** If you plan to use SLP to resolve tree names, it should have been properly configured and SLP DAs should be stable.

If you don't want to (or cannot) use SLP, you can use a flat file, `hosts.nds`, to resolve tree names to server referrals. The `hosts.nds` file can be used to avoid SLP multicast delays when an SLP DA is not present in the network.

`Hosts.nds` is a static lookup table used by eDirectory applications to search eDirectory partition and servers. See the `hosts.nds` man page for more details.



If you decide to use SLP to resolve the tree name, you can determine if the eDirectory tree is advertised (after eDirectory and SLP are installed) by entering the following:

```
/usr/bin/slpinfo -s "ndap.novell///(svcname-ws==[tree_name or *])"
```

- **eDirectory interoperability with OpenSLP on Linux.** Novell SLP v1 is now an optional package. In fact, Novell recommends using a third-party SLP solution, such as OpenSLP (which is SLP v2), if a more robust SLP solution is needed.

If OpenSLP RPMs are already installed on Linux, the eDirectory installation will skip the Novell SLP installation. eDirectory uses the platform-specific SLP APIs by default.



For additional information on OpenSLP, see <http://www.openslp.org/>.

For instructional and course flow purposes, this topic is introduced after installing eDirectory.

However, in a production environment, resolving time synchronization issues should be addressed and resolved before installing eDirectory.

## Time Synchronization and eDirectory

Time synchronization is the next foundation layer required for proper eDirectory operation.

Because eDirectory is a distributed environment in which asynchronous events occur, time synchronization is an important factor in ensuring these events take place in the proper sequence.

If accurate time is not kept, events can happen out of sequence, which can result in inconsistent information about what took place and when it happened.

The server process that synchronizes the information in the eDirectory database requires this type of time synchronization.

To understand time synchronization in eDirectory, you need to know the following:

- The Relationship Between Time Synchronization and eDirectory
- NTP Design Configuration
- Linux and Network Time Protocol

### **The Relationship Between Time Synchronization and eDirectory**

Time synchronization is not a service provided by eDirectory. However, it is a very important part of maintaining the integrity of the eDirectory tree.

Time synchronization is also becoming more dependent on NTP (Network Time Protocol) as the eDirectory environment expands to include mixed operating system environments.

Every time a change is made to an object, the change is time stamped to allow the change to be made in the proper sequence on all servers holding a copy of that object.

Without proper time synchronization, it would be possible to have servers in the tree with different times while holding copies of the same eDirectory objects.

In such a situation, you could change a user's password on 1 server and this change might not propagate to the second server properly.

The user might be forced to log in with the old password instead of the recently updated password.

Because eDirectory is distributed and replicated, changes can occur in different replicas. eDirectory tracks and collates these changes.

Changes you make to objects occur in an eDirectory replica. From there, the change is communicated throughout the network to other replicas in the replica list.

If the same object is modified in 2 different replicas of the partition or is modified twice in the same replica, the order in which the modifications were made must be preserved to ensure database integrity.

### **NTP Design Configuration**

NTP functions as part of the UDP protocol suite, which is part of the TCP/IP protocol suite. Therefore, a computer using NTP needs the TCP/IP protocol suite loaded.

Any computers on your network with Internet access can get time from NTP servers on the Internet. NTP synchronizes clocks to the Universal Time Coordinated (UTC) standard, the international time standard.

NTP introduces the concept of a stratum. Stratum-*x* is used as a designation of the location of the servers in NTP tree hierarchy.

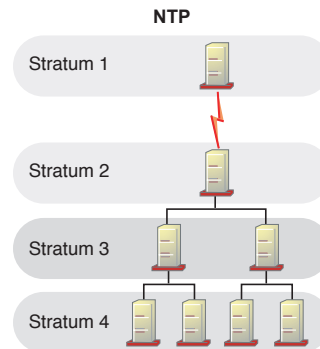
Stratum-1 is the first (highest) level in the hierarchy and it denotes servers that adjust their time by means of some external reference time source (such as GPS and radio).

Servers that synchronize their time to Stratum-1 servers are denoted as Stratum-2, and those that use Stratum-2 servers to synchronize their time are denoted as Stratum-3, and so on.

Differences between Stratum-2 and Stratum-1 servers are normally very small and, for the majority of users, unnoticeable.

Time providers are arranged in a hierarchal manner throughout the network to achieve efficient time synchronization, such as the following:

**Figure 3-4**



The only way to achieve time synchronization in a mixed environment is by using an open standard protocol such as NTP for time synchronization.

It is important that time is synchronized between all platforms running Novell eDirectory. Windows® uses an NTP service, Linux® and UNIX® platforms use ntpd, and NetWare® uses TIMESYNC with NTP awareness.

### Linux and Network Time Protocol

Linux uses a time synchronization service called the NTP Daemon (Red Hat) or the XNTP Daemon (SuSE). Both daemons work much the same way as W32Time. You configure the daemon to obtain time from a particular time server using ntp.conf and then start the service.

To configure the NTP or XNTP daemon, do the following:

1. If not installed already, install the daemon.



The NTP Daemon can be obtained from online sources (such as <http://www.redhat.com> or <http://www.suse.com>) or from your Linux installation CDs.

2. Edit the **/etc/ntp.conf** file using a Linux text editor.
3. Above the Fudge command, make sure the following command exists and points to the time server:

**server *ip\_address***

The time server IP address can be either an NTP server or another time server in your tree.

4. Save the file and exit the editor.
5. At the Linux console prompt, do the following:
  - a. Enter **ntpdate *ip\_address***.

This causes a one-time update of the Linux server time with that of the chosen time server.
  - b. Enter **/etc/rc.d/init.d/ntpd start** (for Red Hat) or **/etc/init.d/xntpd start** (for SuSE).

This starts the daemon, which ensures time synchronization on your Linux server.

## Partitions and Replication in eDirectory

eDirectory is a distributed database with features such as partitioning and replication that support storing portions of the eDirectory database on multiple servers and provides fault tolerance by distributing multiple copies of the same information across the network.

To understand how partitions and replication facilitate this distribution, you need to know the following:

- Partitioning
- Partition Size and Number

- Replica Types
- Replica Rings

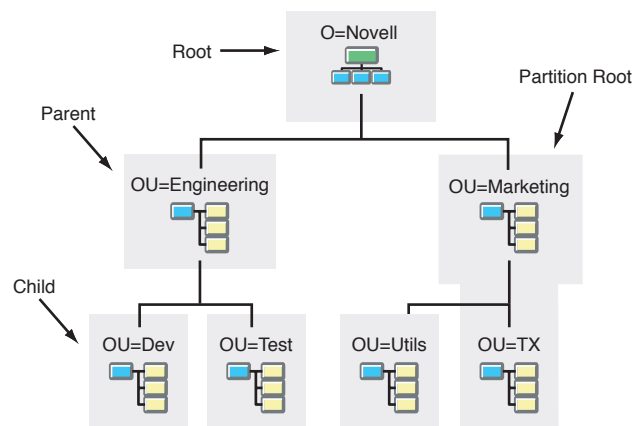
### Partitioning

Partitioning is the process of dividing the eDirectory database. You can divide the eDirectory database into logical units (called *partitions*) that can be distributed among multiple servers.

Partitions only contain eDirectory information. They do not include information on the file system, directories, or files.

The following illustrates a partitioned tree:

**Figure 3-5**



The name of the partition root object is also the name of the partition.

The 6 partitions in this diagram have the following names: Novell, Engineering, Dev, Test, Marketing, and Utils. The top or root partition of the tree can be called either *Novell* or *Root*.

In this example, point out that Novell is a parent partition and that Engineering is a child.

When a partition is subordinate to another in the eDirectory tree, it is referred to as a *child partition*. The partition above it is referred to as the *parent partition*.

This means that engineering.novell is a parent partition and dev.engineering.novell and test.engineering.novell are child partitions.

Although the figure shows the eDirectory tree divided into 6 partitions, users browsing the tree see it as a single entity.

Partitioning and replication provide the following benefits:

- **eDirectory fault tolerance.** Partitioning with replication provides fault tolerance for eDirectory by redundantly storing eDirectory data on various servers.

If a disk crashes or a server goes down, a replica on a server in another location can still authenticate users to the network and provide information about objects in the disabled server's replica.

With the same information distributed on several servers, clients are not dependent on any single server for network authentication or services.



---

Partition replication does not provide fault tolerance for the file system. Only information about eDirectory objects is replicated.

---

- **Efficient access to eDirectory information.** Partitioning and replication improve network response time and reduce network traffic by decreasing the size of the database and placing information near the users who need it the most.

Distributing specific eDirectory information to servers that are physically near workgroups, or to users who frequently access the information, greatly increases the performance of authentications, modifications, and searches.

As a result, information is retrieved from the nearest available server containing the specified information.

Access to information that exists in replicas of partitions across WAN links is improved and WAN traffic is decreased (depending on the amount of synchronization required).

### **Partition Size and Number**

With eDirectory 8.7.x, there are no hard and fast rules regarding partition size or the numbers of objects and replicas.

However, there are practical limitations to all of these parameters. These limitations depend on various factors:

- The number of objects
- The rate at which object information is changing
- The number and type of attributes changing
- The available bandwidth between servers
- The distance between replicas
- The speed of replication
- The number of replicas to synchronize to
- The applications running on the network
- The acceptable latency

As the number of objects and replicas increases, the database becomes more loosely consistent. The limit of the number of objects or number of replicas is reached when the latency involved in synchronization exceeds the acceptable latency.

As a result, partitions which must synchronize across slower WAN links might need to hold smaller numbers of objects to achieve acceptable performance.

### Replica Types

A single instance of a partition is called a *replica*. When you create a partition, the first replica is called the *master* replica. A partition can have only 1 master replica.

A server can contain many replicas, but the server can contain only 1 replica of each partition.

Distributing replicas on multiple servers is called *replication*.

Replicating eDirectory partitions over multiple servers provides fault tolerance and accessibility. For example, if a server goes down, a user can log in to eDirectory and use the unaffected resources.

In eDirectory, there are 6 replica types:

**Table 3-3**

Replica Type	Description
Master	<p>A master replica is a writable replica that contains all object information for the partition. All partition operations (create, merge, move, and abort) occur from the master replica of the given partition.</p> <p>Only 1 master replica can be defined for each partition.</p>
Read/Write	<p>A read/write replica contains the same object information as the master replica. It allows modifications (writes) when a master replica of the given partition is already defined somewhere else.</p> <p>There can be any number of read/write replicas. However, less than 10 are recommended, since they all have to communicate.</p> <p>Client workstations can update master and read/write replicas only.</p>

**Table 3-3** *(continued)*

When discussing subordinate references, try writing “Tree connectivity” on the whiteboard. Diagram a tree, showing the partitions. Use solid lines to designate a parent partition and dashed lines to indicate the child partition to show “where a parent is and the child is not.”

Replica Type	Description
Read-Only	A read-only replica contains the same object information as the partition, but the information can only be read. It is used where partition reads are required but writes to the partition should not occur.
Subordinate Reference	<p>A subordinate reference replica cannot be modified by any user. It is automatically placed on a server by eDirectory if the server holds a master, read/write, or read-only replica of the parent partition and has no replica of the child partition.</p> <p>If you add a read/write or read-only replica of the child partition to the server, the subordinate reference replica is removed.</p>
Filtered Read/Write	<p>Filtered read/write replicas contain a filtered set of objects or object classes along with a filtered set of attributes and values for those objects. The contents are limited to the types of eDirectory objects and properties specific in the host server's replication filter.</p> <p>Users can read and modify the contents of the replica, and eDirectory can access and change selected object information. The selected changes are then automatically propagated to all replicas.</p>

**Table 3-3** *(continued)*

Replica Type	Description
Filtered Read-Only	<p>Filtered read-only replicas contain a filtered set of objects or object classes along with a filtered set of attributes and values for those objects. They receive synchronization updates from master and read/write replicas but don't receive changes directly from clients.</p> <p>Users can read but not modify the contents of the replica. The contents are limited to the types of eDirectory objects and properties specific to the host server's replication filter.</p>

Both the master and read-write replicas can be used to create, modify, and delete objects; however, only the master replica can be used to create and delete subordinate partitions.

The master is also required for the move operation and for all partition operations. A read-only replica can be used only to read the information in the partition; it cannot be used to write to the partition.

Filtered replicas contain a filtered set of objects or object classes along with a filtered set of attributes and values for those objects.

For example, on a single server you might want to create a set of filtered replicas that contain only User objects from various partitions in the eDirectory tree.

In addition to this, you can choose to include only a subset of the user objects' data (for example, Given Name, Surname, and Telephone Number).

When using a subset, it is helpful to know the type of information that is updated. For example, if you use a subset of a user object, be sure to include attributes/properties (such as last login) that are updated.

Other than the ability to filter data stored in a local database, the filtered replica is like a normal eDirectory replica and it can be changed back to a full replica at any time.

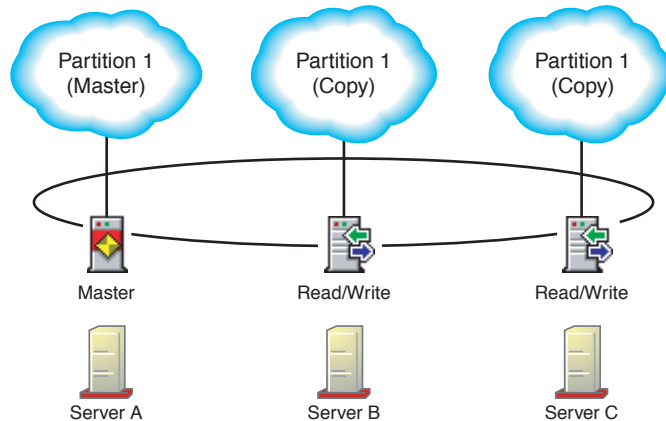
A filtered replica can construct a view of eDirectory data onto a single server. To do this, filtered replicas let you create a scope and a filter. This results in an eDirectory server that can house a well-defined data set from many partitions in the tree.

### Replica Rings

A *replica ring* (or *replica list*) contains a list of servers that hold a copy or replica of a partition.

For example, in the following servers A, B, and C each hold a replica of Partition 1:

**Figure 3-6**



Changes made to objects within a partition are sent to all other replicas of that partition using the replica ring of the partition root object.



You can view a replica ring for each partition in iMonitor. The replica ring includes

- A list of each server containing the replica
- The type of replica
- The replica's current state

The replica list is stored in each replica as a Replica attribute of the partition's root-most container entry.

This list provides information needed for navigating the eDirectory tree and synchronizing the replicas, and is often called the replica ring.

All replicas, including subordinate references, contain a copy of the replica ring.



It is always a good idea to keep all servers in a replica ring on the same version of eDirectory. The more mixed versions of eDirectory you have in the ring, the greater your chance of interoperability problems.

---

Servers in a replica ring do not all have to use the same transport protocol. Some servers can be configured to use only IPX while others use only IP.



IPX does not need to be bound to all servers in a tree if a NetWare 4.11 server is present.

---

The only requirement for using multiple protocols in a replica ring is that at least 1 of the servers in the ring must support multiple protocols. To prevent a single point of failure, more than 1 server should support multiple protocols.

## Transport Layer Security (TLS)

eDirectory 8.7.x provides support for Transport Layer Security/Secure Sockets Layer (TLS/SSL) services based on the OpenSSL source code.

TLS allows for connections to be encrypted in the session layer. The encrypted port doesn't have to be used to get a TLS connection; there's another way.

Port 636 is the implied TLS port, as illustrated in the following properties for the Novell LDAP Server object for server DA1:

Figure 3-7

**Modify Object:** LDAP Server - DA1

Connections

---

**Transport Layer Security (TLS / SSL)**

Server Certificate: SSL CertificateDNS

Client Certificate: Not Requested

Trusted Root Containers:

☐ Require TLS for all operations

☒ Enable and require mutual authentication

**Ports**

☒ Enable Encrypted Port  
Port: 636

☒ Enable Non-Encrypted Port  
Port: 389

**Restrictions**

Concurrent Bind Limit: 0 binds (0 for no limit)

The LDAP server automatically starts a TLS session when a client connects to the secure port.

A client can also connect to the clear-text port (non-encrypted port) and later use TLS to upgrade the connection to an encrypted connection.

**15 minutes**

### **Exercise 3-1 Explore Your eDirectory Tree with iManager**

After installing eDirectory with the NNLS install script, you can use iManager to view and explore your eDirectory tree.



In this exercise you use iManager to explore your eDirectory tree and LDAP object properties.

Do the following:

1. From your NNLS server desktop, start **Mozilla**; then access iManager for your eDirectory tree by entering the following:  
**`https://dax.your container/nps/iManager`**  
After a few moments, the iManager login page appears.
2. Log in by entering **admin** and a password of **novell**; then select **Login**.
3. At the left under eDirectory Administration, select **Modify Object**.

The following Modify Object page appears:

**Modify Object**

Object name:   

4. At the right of the Object name field, select the **Object Selector** icon (magnifying glass).

**Figure 3-8**

The following Browse Directory page appears:

Figure 3-9



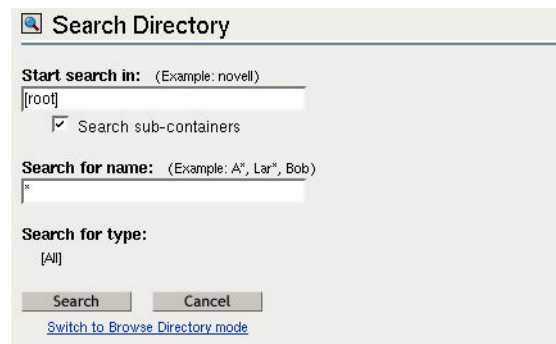
The screenshot shows the "Browse Directory" dialog box. It has a title bar with a magnifying glass icon and the text "Browse Directory". Below the title bar, there are three input fields: "Look in:" with a dropdown menu showing "(Example: novell)" and "[root]", "Look for name:" with a dropdown menu showing "(Example: A\*, Lar\*, Bob)" and an empty text box, and "Look for type:" with a dropdown menu showing "[All]". At the bottom, there are two buttons: "Browse" and "Cancel". Below the buttons, there is a link that says "Switch to Search Directory mode".

From here you can select Browse to move up and down through your eDirectory tree beginning at the object listed in the Look in field.

5. Select **Switch to Search Directory mode**.

The following Search Directory page appears:

Figure 3-10



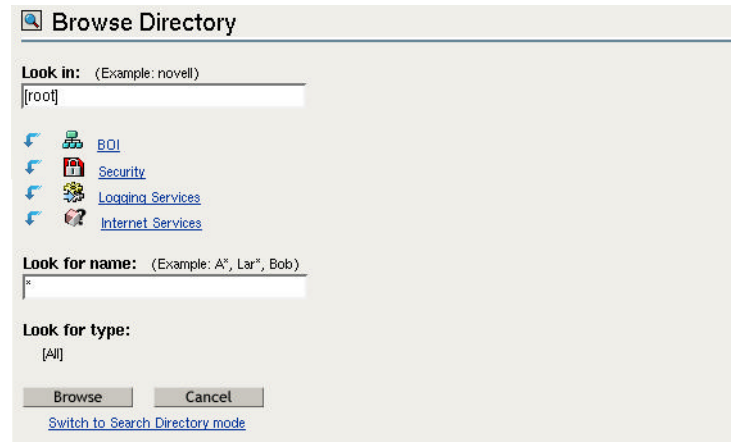
The screenshot shows the "Search Directory" dialog box. It has a title bar with a magnifying glass icon and the text "Search Directory". Below the title bar, there are three input fields: "Start search in:" with a dropdown menu showing "(Example: novell)" and "[root]", "Search for name:" with a dropdown menu showing "(Example: A\*, Lar\*, Bob)" and an empty text box, and "Search for type:" with a dropdown menu showing "[All]". There is also a checkbox labeled "Search sub-containers" which is checked. At the bottom, there are two buttons: "Search" and "Cancel". Below the buttons, there is a link that says "Switch to Browse Directory mode".

From here you can specify a place to start the search for an object in your eDirectory tree and an object name to search for.

6. To browse through your eDirectory tree, select **Switch to Browse Directory mode**; then select **Browse**.

A page similar to the following appears:

Figure 3-11



Several containers (such as **Security**) are displayed, including your container that you specified during NNLS installation.

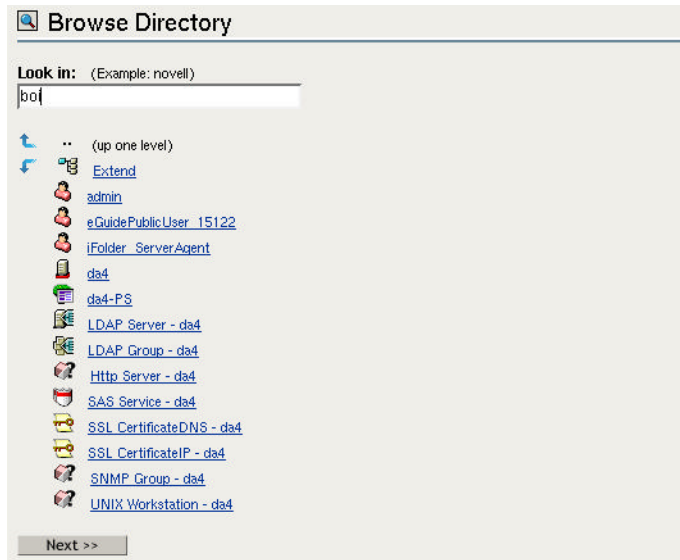
Notice the arrows to the left of the containers. You select these arrows to browse up and down through the tree structure.

When you find the object you want to modify, you select the object name and the browser closes.

7. View the contents of **your container** by selecting the **down arrow** to the left of the container icon.

You see a list of eDirectory objects similar to the following:

**Figure 3-12**



Notice the Next button at the bottom of the list. This indicates that not all the eDirectory objects are displayed.

8. Display the remainder of the eDirectory objects in *your container* by selecting **Next**.
9. Return to the beginning of the list by selecting **Previous**.
10. Select the **LDAP Server - DAx** server object name; then select **OK**.

The Modify Object page for LDAP Server - DAx appears.

11. From the drop-down list at the top of the page, select **General: Connections**.

Is TLS required for all operations on your NNLS server?

By default, TLS is not enabled for LDAP connections when you install eDirectory. Instead, a TLS session is started automatically each time you access the secure port (636).

12. Select **Cancel** (bottom of the page); then select **Modify Object**.
13. Browse to and select the **LDAP Group - DAx** object; then select **OK**.

Notice that your LDAP server (LDAP Server - DAx) is listed as part of the LDAP group.

Also notice that TLS is required for simple LDAP binds with passwords. This ensures that passwords are encrypted and can only be sent through the secure port (636).

In fact, when you logged into iManager, you used https to connect to the secure port, which ensured that the password was sent as encrypted (instead of clear) text.

14. Select **Cancel**.
15. (Optional) Try exploring other objects and containers in your eDirectory tree.
16. When you finish, exit iManager by selecting the **Exit** icon at the top of the iManager page.
17. Close the Mozilla browser.

*(End of Exercise)*

### ***eDirectory and LDAP***

With the development of Internet and intranet technologies, networks are much larger and more complex than in the past. These larger networks create a greater need for a comprehensive directory service and a standard method for accessing information.

LDAP is an Internet communications protocol that lets client applications access directory information.

It is based on the X.500 Directory Access Protocol (DAP), but it is less complex than a traditional client and can be used with any directory service that follows the X.500 standard and provides an LDAP server component.

To understand eDirectory and LDAP, you need to know the following:

- Records and Attributes
- LDAP Naming Contexts and eDirectory Partitions
- Novell LDAP Server Object
- Novell LDAP Group Object
- How LDAP Clients Bind to eDirectory
- LDAP Data Interchange Format (LDIF)

### **Records and Attributes**

In LDAP standards documentation, an entry consistently means a record in the directory database. In eDirectory, a record is called an *object* (although some eDirectory developer documentation is beginning to use the LDAP term *entry*).

In most directory documentation, the term *attribute* refers to the *fields* of a record. LDAP and X.500 conform to this standard. A lot of LDAP documentation also uses the word *attribute* to refer to the attribute's value.

Most eDirectory documentation also uses the term *attribute*; however, *properties* is also used to describe fields in a record.

### **LDAP Naming Contexts and eDirectory Partitions**

In LDAP, a *naming context* is the same thing as an eDirectory *partition*.



Just as an eDirectory partition is a branch of the NDS tree with only 1 parent, an LDAP naming context specifies a branch of a hierarchical tree.

### Novell LDAP Server Object

The Novell LDAP Server object stores configuration data for an eDirectory LDAP server. The installation process creates an LDAP server object named **LDAP Server - <server\_name>** in the same container as the NCP Server object.

The LDAP server module in eDirectory reads its configuration from the LDAP server object and then makes native calls to eDirectory in response to incoming LDAP requests.

The LDAP server module used on each platform is

- **NetWare:** NLDAP.NLM (NLM)
- **Windows:** NLDAP.DLM (NDS Services)
- **Unix/Linux:** /usr/sbin/nldap (daemon)

Upon initialization—either when the module loads or when the server is refreshed—the server module reads the configuration from the LDAP server object and the LDAP group object.

### Novell LDAP Group Object

The Novell LDAP Group object stores configuration data such as the following:

- Referral options
- Object class attribute mappings between LDAP clients and eDirectory
- Proxy user authentication
- TLS simple binds with password setting

This configuration data can be applied to a single LDAP server or a group of LDAP servers.



---

If the same configuration is needed on multiple servers, configure 1 LDAP Group object and assign it to each of the LDAP Server objects in the eDirectory tree that the configuration should apply to.

---

The LDAP Group is used to configure class and attribute mappings as well as LDAP-related security policies for the server.

Using LDAP Group objects simplifies configuration changes, because 1 configuration change can be applied instantly to multiple LDAP servers.

During installation, an LDAP Group object named **LDAP Group <server\_name>** is created in the same container as the Server object.

### How LDAP Clients Bind to eDirectory

All LDAP clients bind or connect to eDirectory as one of the following types of users:

- [Public] User (Anonymous Bind)
- Proxy User (Proxy User Anonymous Bind)

The type of bind the user authenticates with affects the information the LDAP client can access. The information displayed is based on the effective rights of the currently bound object.

#### [Public] User (Anonymous Bind)

An anonymous bind is a connection that does not contain a username or password.

When an LDAP client sends a request to Novell's LDAP server, eDirectory completes the request for only those attributes to which the LDAP client has the appropriate access rights.

If an LDAP client binds to a Novell LDAP server without a username or password (and the service is not configured to use a proxy user), the session is authenticated to eDirectory as the [Public] object.

By default, the [Public] identity is assigned browse rights to the objects in the eDirectory tree. The default browse right for [Public] allows users to browse eDirectory objects but blocks access to most object attributes.

The default [Public] rights are typically too limited for most LDAP clients. Although you can change [Public]'s rights, changing them gives these rights to all users, including unauthenticated users.

In addition, there are many eDirectory configurations that depend on [Public]'s rights, and changing those rights might have unintended consequences.

Because of this, Novell recommends that you use a Proxy User for anonymous binds.

### **Proxy User (Proxy User Anonymous Bind)**

An anonymous bind using a proxy user is an anonymous connection linked to an eDirectory user object.

You can configure a proxy user to act in behalf of all anonymous binds by doing the following:

1. Create a new account with an empty password (for key pair generation).
2. Restrict this user from changing the password.
3. Give this user rights to read/write information that you want anonymous users to be given.

4. Associate this account to the LDAP group object.
5. Refresh the LDAP server configuration.

If an LDAP client binds to a Novell LDAP server anonymously and the server is configured to use a proxy user, then the client uses the effective rights of the proxy user.

The following are additional guidelines for configuring the proxy user:

- All LDAP client access through anonymous binds is assigned based on the rights of the proxy user.
- The proxy user must have no password and no password restrictions because LDAP clients do not supply passwords during anonymous binds. Do not force the password to expire or allow the proxy user to change passwords.
- You can limit the locations that the user can log in from by setting address restrictions for the Proxy User object.

To do this, configure the proxy user's network address restrictions to allow authentication only from the IP address assigned to the server or servers the proxy user will be used at.

- The proxy user object must exist in eDirectory and be assigned rights to the eDirectory objects you want to publish.

The default user rights provide read and browse access to a limited set of objects and attributes. Assign the proxy user read and browse rights to all objects and attributes in each subtree where access is needed.

- The proxy user object must be enabled on the general page of the LDAP group object that is used to configure the Novell LDAP server. Because of this, there is only 1 proxy user object for all servers in an LDAP group.

## LDAP Data Interchange Format (LDIF)

LDIF is used to represent directory information—in particular, directory change information—in text files.

An LDIF file consists of a series of records separated by line separators. A record consists of a sequence of lines describing a directory entry, or a sequence of lines describing a set of changes to a directory entry.

An LDIF file specifies a set of directory entries or a set of changes to be applied to directory entries, but not both.

There is a one-to-one correlation between LDAP operations that modify the directory (add, delete, modify, and modrdn), and the types of change records described below (“add,” “delete,” “modify,” and “modrdn” or “moddn”)

This correspondence is intentional and permits a straightforward translation from LDIF change records to LDAP protocol operations.

The following are operations you find in an LDIF file:

- Add
- Delete
- Modrdn
- Modify

In addition, you can use the following utility to manage LDIF files:

- Novell Import/Convert/Export (ICE) Utility

### Add

Many LDAP operations can be included in a single LDIF file. The first operation listed is an *add* operation, indicated by the changetype value.

The following is an example of an LDIF document with 2 add operations:

```
version: 1

#add new entry
dn: cn=Fiona Jensen,ou=users,o=acme
changetype: add
objectclass: inetorgperson
sn: Jensen
telephonenumber: +1 216 555 1212
title: Manager
```

```
dn: cn=John Smith,ou=users,o=acme
changetype: add
objectclass: inetorgperson
sn: Smith
telephonenumber: +1 801 555 1212
title: Engineer
```

Each attribute is added in a name:value syntax. Multi-valued attributes are added by repeating the name:value pair for each value.

### Delete

A *delete* operation is very simple. A special attribute of dn: specifies the distinguished name of the entry to delete. The only other item to add for a delete operation is to set the *changetype* to delete.

The following is an example of an LDIF document with 3 delete operations:

```
version: 1
#delete an entry
```

```
dn: cn=Joy Smith,ou=test,ou=users,o=acme
changetype: delete
```

```
dn: ou=Bob,ou=test,ou=users,o=acme
changetype: delete
```

```
dn: ou=test,ou=users,o=acme
changetype: delete
```

### **Modrdn**

The *modrdn* operation shown in the following LDIF document is an example of renaming an entry:

```
version: 1
#modify an entry's relative distinguished name
dn: cn=Fiona Jensen,ou=users,o=acme
changetype: modrdn
newrdn: Fiona Jones
deleteoldrdn: 1
```

The item of deleteoldrdn:1 will delete the old relative distinguished name.

### **Modify**

The first example of the modify operation in the following LDIF file modifies an entry by deleting the *description* attribute, replacing the *telephonenumber* attribute with 2 values, and deleting the *facsimiletelephonenumber* attribute:

```
version: 1
```

```
dn: cn=Fiona Jensen,ou=users,o=acme
changetype: modify
-

delete: description
-

replace: telephonenumber
telephonenumber: +1 216 555 1212
telephonenumber: +1 216 555 2121
-

delete: facsimiletelephonenumber
-

dn: cn=Robert Smith,ou=users,o=acme
changetype: modify
-

delete: title
-

add: postaladdress
postaladdress: 123 Anywhere Drive
-
```

The second example modifies an entry to delete the title attribute and adds a *postaladdress* attribute; if a value already exists, a second value is added and the original value is left alone.



---

Note the inclusion of the lines with a “-” character in them. Most LDIF interpreters need this in order to know to move to the next sub-operation of the modification.

---



### **Novell Import/Convert/Export (ICE) Utility**

The Novell Import/Convert/Export (ICE) utility lets you do the following:

- Import data from LDIF files to the LDAP directory
- Export data from the LDAP directory to an LDIF file
- Migrate data between LDAP servers
- Import and export comma-separated (CSV) files

ICE manages a collection of handlers that read or write data in a variety of formats. Source handlers read data, while destination handlers write data.

If an LDIF data file needs to be imported into an LDAP directory, the Novell ICE engine uses an LDIF source handler to read the LDIF file and an LDAP destination handler to send the data to the LDAP directory server.

To use the ICE utility, you need to understand the following:

- **Novell ICE Wizard and LBURP.** You start the Novell ICE utility wizard from iManager, as shown in the following:

Figure 3-13

ICE Wizard

Welcome to the ICE Wizard

The ice wizard will step you through the import, export or migration of data.

Select the task you would like to perform.

☒ Import data from file on disk  
☐ Export data to a file on disk  
☐ Migrate data between servers

**Advanced Settings**

☐ Run in verbose mode

Schema rules:

Placement rules:

Novell ICE is capable of using the LDAP Bulk Update/Replication Protocol (LBURP) to send asynchronous requests to an LDAP server.

This guarantees that the requests are processed in the order specified by the protocol and not in an arbitrary order influenced by multiprocessor interactions or the operating system's scheduler.



The Novell ICE wizard requires an LDAP server for import and export. You enter server information such as the server name or IP port, trusted root of the LDAP server (if over SSL), and authentication credentials.

LBURP also lets the ICE utility send several update operations in a single request and receive the responses for all those update operations as a single response.

The LBURP protocol lets the ICE utility present data to the server as fast as the network connection between the client and server allows.

If the network connection is fast enough, the server will stay busy processing update operations 100% of the time because it never has to wait for the ICE utility to give it more work to do.

The LBURP processor in eDirectory also commits update operations to the database in groups to gain further efficiency in processing the update operations. LBURP can greatly improve the efficiency of LDIF imports over a traditional synchronous approach.

- **Novell ICE Command Line Utility.** On Linux and Solaris® systems, the ICE command line utility is included in the NDSadmutl package.

You can start ICE from a command prompt by using the following syntax:

***ice general\_options -S <source handler> <source handler options> -D <destination handler> <destination handler options>***

General options include the following:

**Table 3-4**

Option	Description
-C	Specifies that you are using the schema cache to perform schema compare and update
-l <i>log_file</i>	Specifies a filename where output messages are logged
-o	Overwrites the existing log file rather than appending to it

**Table 3-4** *(continued)*

Option	Description
<b>-e</b> <i>LDIF_file</i>	Creates an LDIF-formatted file with the failed entries
<b>-p</b> <i>URL</i>	Specifies the location of an XML placement rule to be used by the engine
<b>-c</b> <i>URL</i>	Specifies the location of an XML creation rule to be used by the engine
<b>-s</b> <i>URL</i>	Specifies the location of an XML schema mapping rule to be used by the engine
<b>-b</b> (NetWare only)	Specifies to not pause for input at the ICE console screen at the end of execution
<b>-v</b>	Runs in verbose mode
<b>-h</b> or <b>-?</b>	Displays command-line help

After the general options, you specify the source and destination handlers:

- ❑ **-S**[LDIF | LDAP | DELIM | LOAD | SCH] *source\_options*
- ❑ **-D**[LDIF | LDAP | DELIM] *destination\_options*

The following are 3 examples of using ICE from the command line:

- ❑ **ice -e \root\ldif\errors.ldif -o -l c:\log.txt**
- ❑ **ice -S LDIF -f \root\ldif\add.ldif -c -v**
- ❑ **ice -D LDAP -s ldapsvr.novell.com -p636 -d cn=admin,o=novell -w passwd -L \root\ldif\SelfSignedCert.der**

**20 minutes**

This exercise is required for students to be able to successfully complete other exercises in the course.

### ***Exercise 3-2 Import an LDIF File***

To finish configuring your eDirectory tree, you need to add employees and groups to populate your container.

In this exercise you use an LDIF file and the ICE wizard to add employees and groups.

Do the following:

1. Copy the LDIF file from the *3015 Course CD* to **/tmp**:
  - a. From a terminal session, log in as root by entering **su -** and a password of **novell**.
  - b. Insert the *3015 Course CD* in your NNLS server.
  - c. Mount the CD by entering **mount /media/cdrom**.
  - d. Change to the directory containing the LDIF files by entering **cd /media/cdrom/LDIF**.
  - e. Copy your LDIF file to the /tmp directory by entering **cp your\_container.ldif /tmp**.

For example, if your container is LAX, you enter the following:

**cp lax.ldif /tmp**
  - f. Change to the root directory by entering **cd /root**.
  - g. Enter **umount /media/cdrom**; then remove the CD from your NNLS server.
2. From the Mozilla browser, start iManager with the following URL:  
**https://dax.your\_container.digitalairlines.com/nps/iManager**
3. At the Login page, log in as **admin** with a password of **novell**.

4. At the left under **eDirectory Maintenance**, select **Import Convert Export Wizard**.

The Welcome page for the ICE wizard appears.

5. Make sure **Import data from file on disk** is selected; then select **Next**.
6. To the right of the File to import field, select **Browse**; then browse to **/tmp** and select the LDIF file that you copied to your /tmp directory.
7. Select **Open**.

The full path to the LDIF file is inserted into the File to import field.

8. Under Advanced settings (below the File to import field), deselect **Exit on error**; then make sure that **Add records without change type** is the only option selected.
9. Select **Next**.
10. Enter the following information:
  - ❑ Server DNS name/IP address field: **10.0.0.x** (where **x** is the number of your server)
  - ❑ Port: **636**
  - ❑ DER: **/etc/opt/novell/SSCert.der**
  - ❑ Authenticated login: (select)
  - ❑ User DN: **cn=admin,o=your container**
  - ❑ Password: **novell**
11. Scroll down, and under Advanced settings, deselect **Use LBURP**; then select **Allow forward references** (should be the only option selected).
12. Continue by selecting **Next**.

A Summary page with the ice command line is displayed.

**13. Import the LDIF file by selecting **Finish**.**

A progress page is displayed.

When the import finishes, a log is displayed on the page. Notice that 1 error is listed (68) for adding your container (such as BOI) because the container already exists.



---

If the LDIF file did not import, you might have missed selecting or deselecting options such as Exit on Error. Start from step 4 and make sure the correct options under Advanced Settings (and those options only) are selected.

---

**14. Browse your tree (using **Modify Object**) to view the user and group objects added to your container.**

Notice that a Manager role, 2 groups (DBUSERS and WPUSERS), several employees (user objects), and several templates for creating user objects have been added to your container.

**15. Open a user object (such as CGrayson) and view the information stored in the object.****16. When you finish, close the iManager browser window.****17. At the shell prompt, enter **exit**; then close the terminal session window.**

***(End of Exercise)***

## Objective 3      Perform eDirectory Administration Tasks

To perform administration tasks for eDirectory on Linux, you need to know the following:

- Command Line Utilities
- How to Start and Stop eDirectory on Linux
- Where eDirectory Files Are Located
- Novell iManager
- Novell iMonitor
- How to Perform a Health Check in iMonitor

### *Command Line Utilities*

The following command line utilities are available to help you with eDirectory management, monitoring, and troubleshooting tasks:

- **ldapconfig:** Lets you modify, view, and refresh the attributes of LDAP Server and Group objects.
- **ndsbackup:** Creates eDirectory object archives and adds or extracts eDirectory objects.
- **ndsconfig:** Configures Novell eDirectory.
- **ndsimonitor:** Monitors and diagnoses the servers in the Novell eDirectory tree using HTTP.
- **ndslogin:** Verifies eDirectory authentication.
- **ndsmerge:** Lets you merge 2 eDirectory trees.
- **ndsrepair:** Lets you repair and correct problems with the Novell eDirectory database, such as records, schema, bindery objects, and external references.
- **ndsstat:** Lists statistics (such as tree name, server name, and product version) for eDirectory.



- **ndstrace:** Lets you set a trace to troubleshoot eDirectory background processes and transactions.
- **nmasinst:** Lets you configure NMASTM and install login methods.

You can use the **man** command (such as **man ndsconfig**) to view online manual pages for each command.

You can also remove eDirectory from the NNLS server outside of the NNLS installation at a shell prompt by using the **/usr/sbin/nds-uninstall** command.

The following are examples of using some of the above commands:

- **ndsconfig**
- **ndsrepair**
- **ndstrace**



For a complete list of commands and details on using the command line utilities, see the Novell eDirectory 8.7.3 Administration Guide at [www.novell.com/documentation](http://www.novell.com/documentation).

## **ndsconfig**

You can use the **ndsconfig** utility to configure eDirectory. This utility can also be used to add the eDirectory Replica Server into an existing tree or to create a new tree.

To change the current configuration of the installed components, use the following syntax:

**ndsconfig {set *value\_list* | get [*parameter\_list*] | get help [*parameter\_list*]}**

The following are examples of using `ndsconfig` at the shell prompt:

- **`ndsconfig new -t corp-tree -n o=company -a cn=admin.o=company`**

This creates a CORP-TREE with the server installed.

- **`ndsconfig add -t corp-tree -n o=company -a cn=admin.o=company`**

This adds the server to an existing CORP-TREE.

- **`ndsconfig rm -a cn=admin.o=company`**

This removes the eDirectory Server object and directory services from a tree.

### **ndsrepair**

To access `ndsrepair` (DSREPAIR on NetWare) from your Linux server at the shell prompt enter the following:

#### **`ndsrepair command_option`**

The following are examples of using `NDSREPAIR` at the shell prompt:

- **`ndsrepair -U`**

This performs an unattended full repair.

- **`ndsrepair -R`**

This repairs the local database.

- **`ndsrepair -P`**

This lists partitions and replicas and gives access to the Replica Options menu

- **`ndsrepair -N`**

This lists all servers known to this database

## **ndstrace**

To access ndstrace (DSTRACE on NetWare) from your Linux server at a shell prompt enter the following:

### **ndstrace *command\_option***

The following are examples of using ndstrace at the shell prompt:

- **set ndstrace = ON**  
This enables the ndstrace debug screen.
- **set ndstrace = +BLNK**  
This enables backlink and inbound messages and error reports.
- **set ndstrace = \*B**  
This schedules the backlink process to begin.

## ***How to Start and Stop eDirectory on Linux***

After installation, eDirectory is configured to automatically start each time the server is booted.

You can manually start, stop, or restart the eDirectory server using the nds script file located in */etc/rc.d/init.d* (Red Hat) or */etc/init.d* (SuSE).



---

With most Linux daemons, you can use the **chkconfig** command to configure how they start (automatically or manually). However, you cannot use **chkconfig** to configure the eDirectory daemon.

---

To restart the eDirectory server from a shell prompt, do the following:

1. From a shell prompt change to the init.d directory by entering **cd /etc/rc.d/init.d** (Red Hat) or **cd /etc/init.d** (SuSE); then enter **./ndsd stop**.

2. Start the daemon by entering **./ndsd start**.

Information similar to the following appears:

**Figure 3-14**

```
[student@DA3 student]$ su -
Password:
[root@DA3 root]# cd /etc/rc.d/init.d
[root@DA3 init.d]# ./ndsd stop
Stopping Novell eDirectory server...
done
[root@DA3 init.d]# ./ndsd start
Starting Novell eDirectory server...
done
[root@DA3 init.d]# █
```

You can also enter **ndsd restart** to stop and start the daemon with 1 command.

Another option is to restart the eDirectory server from an X Windows desktop. For example, to restart the eDirectory server from the Gnome desktop on Red Hat, do the following:

1. From the panel at the bottom of the desktop, select **Main Menu icon > Programs > System > Service Configuration**.
2. Scroll down the list of services to nds.
3. Select **nds**; then select the **Restart** button.

After a few moments, a message appears indicating that the restart was successful.

4. Select **OK**.

You can also use the Start and Stop buttons to stop and start the nds service.

### ***Where eDirectory Files Are Located***

During a default installation, the following eDirectory directories are created:

- `/var/novell/nici`
- `/var/nds`
- `/etc/nds` (Red Hat) or `/etc` (SuSE)

The **`/var/novell/nici`** directory stores the Novell International Cryptographic Infrastructure (NICI) files.

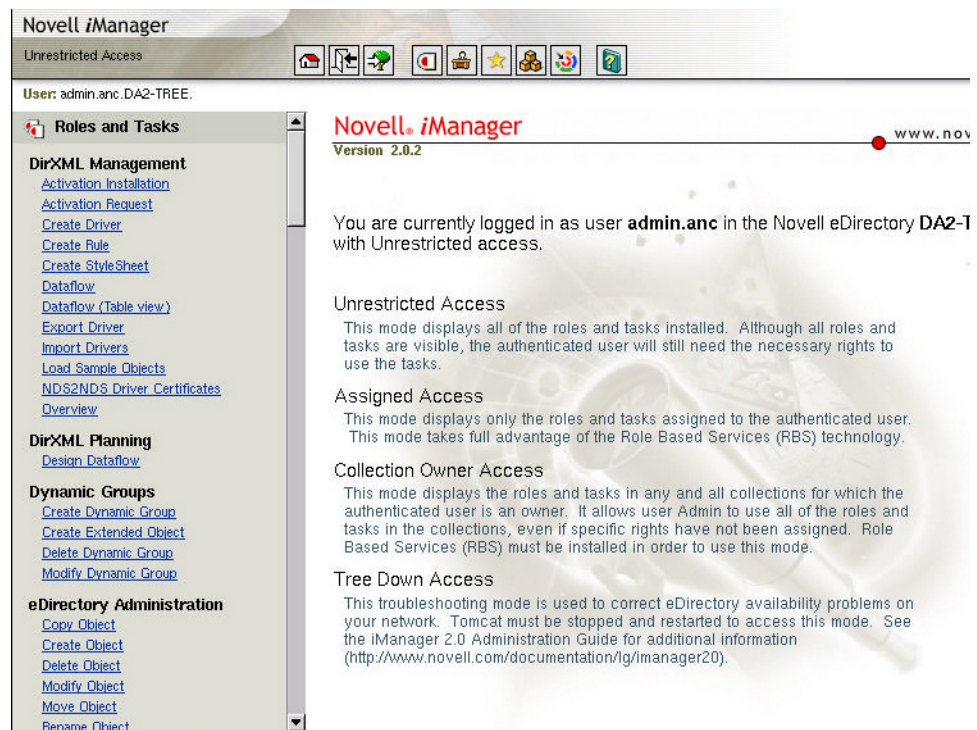
The **`/var/nds`** directory stores a variety of eDirectory files, including log files, eDirectory reports, DIB files, and certificate server files.

The **`/etc/nds`** and **`/etc`** directories store the `nds.conf` (eDirectory configuration) file, along with other eDirectory configuration files for iMonitor.

## Novell iManager

Novell iManager provides a Web-based management tool that uses roles to delegate eDirectory administration, management, and services tasks, as shown in the following figure:

Figure 3-15



Novell iManager consists of the following:

- **eDirectory Management Framework (eMFrame).** Novell eMFrame plug-ins communicate over standard Directory access protocols to perform routine management tasks and communicate with eMBox.

- **eDirectory Management Toolbox (eMBox).** Novell eMBox is the server-side piece that works with iManager to provide Web-based iManager access to functionality in DSRepair, DSMerge, and the Novell Import Convert Export utility.

It also includes Web-based access to the new Backup and Restore functionality. All functions are also accessible, either on the local server or remotely, via a command line client.

- **eDirectory utilities.** The eDirectory utilities available in Novell iManager include DSRepair, DSMerge, Backup and Restore, LDAP, WanMan, and the Novell Import Convert Export utility.

You previously learned how to start iManager in Section 2. In this (and other sections), you are introduced to performing a variety of management tasks with iManager that are critical to maintaining eDirectory.



Novell iManager gives administrators the ability to assign specific responsibilities to users and to present the user with only the tools (and their accompanying rights) necessary to perform those sets of responsibilities. This functionality is called *Role-Based Services* (RBS).

When you first start iManager, not all tasks (responsibilities) may be assigned to the admin user object. For information on assigning additional tasks to admin using RBS, see the *Novell eDirectory Administration Guide* (on your 3015 Course CD).

---

### ***Novell iMonitor***

While Novell iManager gives you the tools for performing management and configuration tasks, Novell iMonitor gives you monitoring and diagnostic capability on all servers in your eDirectory tree.

iMonitor shows the view of eDirectory from the perspective of each server. You can look at eDirectory in depth on a partition, replica, or server basis.

You can also examine what tasks are taking place, when they are happening, what their results are, and how long they are taking, as shown in the following figure:

Figure 3-16

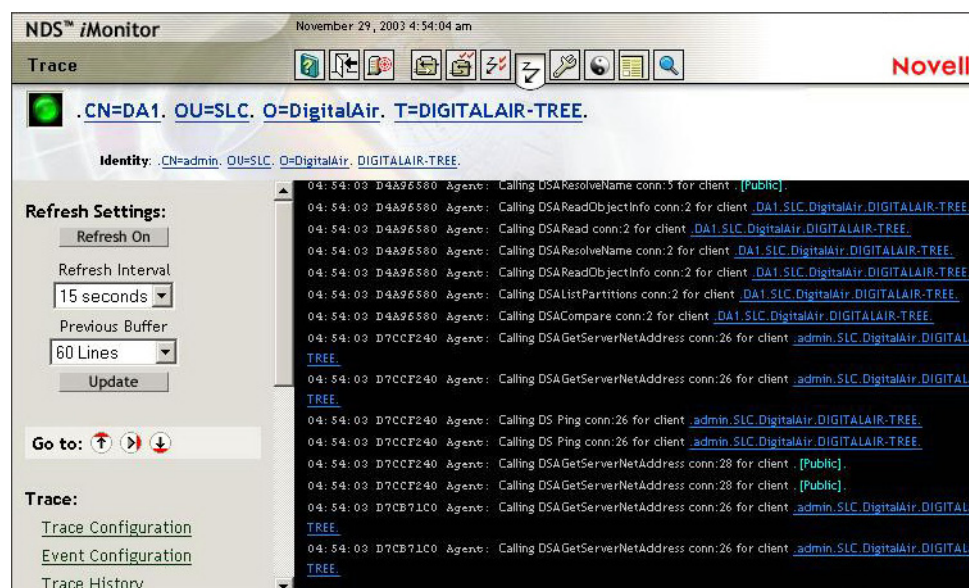


iMonitor provides a Web-based alternative or replacement for many of Novell's traditional server-based eDirectory tools such as DSBROWSE, DSDIAG, and ndstrace.



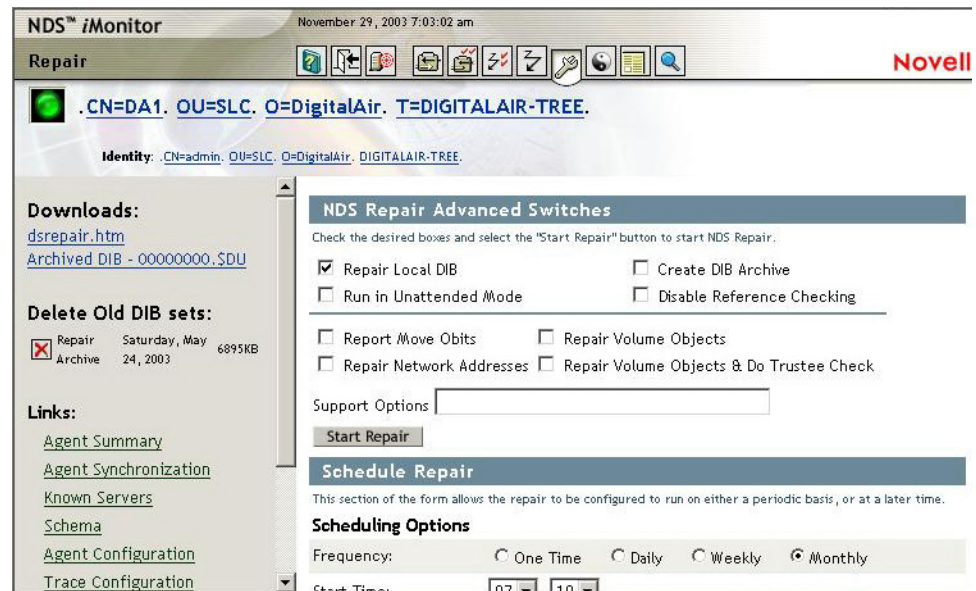
For example, the following shows ndstrace in iMonitor:

Figure 3-17



iMonitor also allows for many of the diagnostic features available in ndsrepair, as shown in the following figure:

Figure 3-18



To understand how to use iMonitor for eDirectory maintenance tasks, you need to know the following:

- iMonitor Modes of Operation
- How to Access iMonitor

### iMonitor Modes of Operation

iMonitor can be used in 2 different modes of operation:

- Direct Mode
- Proxy Mode

### Direct Mode

In direct mode, your web browser is pointed directly at an address or DNS name on a machine running the iMonitor service and reads information only on that machine's local eDirectory DIB.

Direct mode is critical because some iMonitor features are server-centric; that is, they are only available to the iMonitor running on that machine. These features use local API sets that cannot be accessed remotely.

Server-centric features in iMonitor include the NDS trace, NDS repair, and Background Process Schedule pages. When using direct mode, all iMonitor features are available on that machine.

Key features of direct mode include

- Full server-centric feature set
- Reduced network bandwidth (faster access)
- Access by proxy for all versions of eDirectory

### Proxy Mode

In proxy mode, your web browser is pointed at an iMonitor running on 1 machine but is gathering information from another machine.

While in proxy mode, you can switch to direct mode for a different server as long as it is a version of eDirectory that includes iMonitor.

If the server you are gathering information on by proxy has iMonitor running, you will see an additional icon button (telescope) near the top of the screen. When you mouse over the icon, you see a link to the remote iMonitor on the remote server.

If the server you are gathering information on by proxy is an earlier version of eDirectory, no additional icon will be shown. You will always have to gather information on that server by proxy until it is upgraded to a version of eDirectory that includes iMonitor.



Because iMonitor uses traditional eDirectory non-server-centric protocols for non-server-centric features, all previous versions of eDirectory beginning with NDS 6 can be monitored and diagnosed.

---

The following are key features of proxy mode:

- Not every server in the tree must be running iMonitor in order to use most iMonitor features.
- Only 1 server is required to be upgraded.
- There is a single point of access for dial-in.
- You can access iMonitor over a slower speed link while iMonitor accesses eDirectory information over higher speed links.
- Previous eDirectory version information is accessible.

### How to Access iMonitor

The information you can view in iMonitor is based on the following factors:

- **The identity you have established.** Your identity's eDirectory rights are applied to every request you make in iMonitor.  
For example, you must log in as the administrator or console operator on the server where you are trying to access the ndstrace features.
- **The eDirectory agent version you are monitoring.** Newer versions of eDirectory have features and options that older versions do not.

You can securely access iMonitor (for example, as **admin**) by entering the following URL in a web browser:

**`https://IP_or_dns:8010/nds`**

where **IP\_or\_dns** is the IP address or domain name of the server you want to monitor.

You can also use `http://IP_or_dns:8008/nds` for non-secure access, but you will be limited to the features you can use.



You can also configure iMonitor to use HTTPS for secure connections using port 81 or 8009.

The information you view in iMonitor immediately shows what is happening on your server, as shown in the following:

**Figure 3-19**

**NDS™ iMonitor** November 29, 2003 4:47:01 am

**Agent Summary**

**.CN=DA1. OU=SLC. O=DigitalAir. T=DIGITALAIR-TREE.**

**Identity:** .CN=admin. OU=SLC. O=DigitalAir. DIGITALAIR-TREE.

**Links:**

- [Agent Synchronization](#)
- [Known Servers](#)
- [Schema](#)
- [Agent Configuration](#)
- [Trace Configuration](#)
- [Agent Health](#)
- [Agent Process Status](#)
- [Agent Activity](#)
- [Connections](#)
- [Error Index](#)

**Partition Synchronization Status**

Partition	Errors	Last Successful Sync.	Maximum Ring Delta	Replica's Perishable Data Delta	
<a href="#">.DIGITALAIR-TREE.</a>	2	9614:32:42	9614:32:23	9614:32:24	<a href="#">Replica Synchronization, Agent Health, Change Cac Continuity</a>

**Servers Known to Database Totals**

Type	Count	Up	Down	Unknown
<a href="#">Known Servers</a>	4	1	3	0
<a href="#">In Replica Ring</a>	3	1	2	0

The first page you see is the agent summary. You can use this page to view the health of your eDirectory servers, including synchronization information, agent process status, and the total number of servers known to your database.

The page is composed of the following frames:

- **Navigator frame.** The Navigator frame is located across the top of the page. This frame shows
  - The server name where the data is being read from
  - Your identity
  - The icons you can click to link to other screens, including online help, login, server portal, and other iMonitor pagesThese icons make up the iMonitor Toolbar. Using the toolbar, you can quickly switch between informational pages and utilities. You can also switch between servers.
- **Assistant frame.** The Assistant frame is on the left side of the page.

This frame contains additional navigational aids, such as links to other pages, items that help you navigate data in the Data frame, or other items to help you obtain or interpret the data on a given page.
- **Data frame.** The Data frame shows detailed information about your servers that you request by clicking a link in the Assistant frame. This is the only page you will see if your web browser does not support frames.
- **Replica frame.** The Replica frame is in the lower left corner of the browser. It lets you determine which replica you are currently viewing and provides links to view the same information from another replica or server's point of view.

This frame appears only when you view pages where another replica of the requested data exists or where another replica can have a different view of the information being presented in the Data frame.



---

For details on using all the features in iMonitor, see the “Novell eDirectory Administration Guide” at <http://www.novell.com/documentation/lg/edir871/index.html>.

---

### ***How to Perform a Health Check in iMonitor***

Once you have implemented eDirectory 8.7.x, it is important that you know how to monitor and maintain eDirectory.

By monitoring eDirectory, you can prevent or quickly correct problems as they arise.

Use iMonitor to perform a series of system checks to verify that your system is healthy. This series of system checks is known as a health check.

To understand how to perform a health check, you need to know the following:

- Why Health Checks Are Necessary
- When and How Often Health Checks Are Needed
- Health Check Elements
- iMonitor Health Check Procedure
- How to Run an Agent Health Report

### **Why Health Checks Are Necessary**

You perform a health check on eDirectory for many of the same reasons you get regular checkups from your doctor—they help you maintain good health, prevent disease, and identify potential problems before they occur.

Likewise, performing a regular eDirectory health check helps keep your eDirectory tree stable and efficient.

Because the eDirectory tree is the backbone of your company's network, you risk downtime and serious problems if you postpone performing regular eDirectory health checks.

In turn, a stable and efficient eDirectory tree helps keep your company's network running smoothly. The more preventative maintenance you do, the less time you spend troubleshooting problems.

### **When and How Often Health Checks Are Needed**

Deciding how often to perform health checks on your eDirectory tree depends on the activity level of your directory.

In general, if your network doesn't change often (servers and partitions are added only every couple of months and only simple changes are made frequently), perform health checks once a month.

If your network is more dynamic (partitions or servers are added weekly or your organization is reorganizing), perform health checks weekly.

Adjust the frequency of health checks as your environment changes. Factors that influence the timing of your health checks include the following:

- Number of partitions and replicas
- Stability of replica holding servers
- Amount of information in an eDirectory partition
- Object size and complexity
- Number of errors in previous DSRepairs

In addition, you should perform a health check before and after any major change to eDirectory.

When you perform a health check, iMonitor gathers information from all servers based on given rights.





Be aware that running health check reports generates network traffic and uses disk space.

---

## Health Check Elements

A basic health check includes the following health check report elements:

- **eDirectory version.** If your version (or revision level) of eDirectory is outdated, download the latest RPMs from Novell using the Red Carpet daemon.
- **Time synchronization.** Time stamps are assigned to each eDirectory object and property. They ensure the correct order for object and property updates.

Using time stamps, eDirectory determines which replicas need to be synchronized. For synchronization to happen properly, all eDirectory servers must maintain accurate time.

- **Partition continuity.** Partition continuity ensures that all replicas for a partition can be updated with directory changes.

In this course we focus on a basic health check. However, an extended health check includes background processes such as the following:

- **Schema synchronization status.** This process identifies the current condition of schema synchronization.

Schema synchronization ensures that the schema is consistent across the partitions in the eDirectory tree and that all schema changes are updated across the network.

- **Obituaries.** These are created when the distinguished name of an object is changed (such as when objects are deleted, moved, or renamed). Obituaries allow for the database to remain consistent between servers.

- **External references.** External references are placeholders in eDirectory that contain information about entries the server does not hold.

For example, when a user browses the eDirectory tree and requests information about an entry that is not stored locally, eDirectory creates an external reference to the entry.

- **Limber status.** This process ensures that all server information (such as IP address, server name, and external references) is correct.

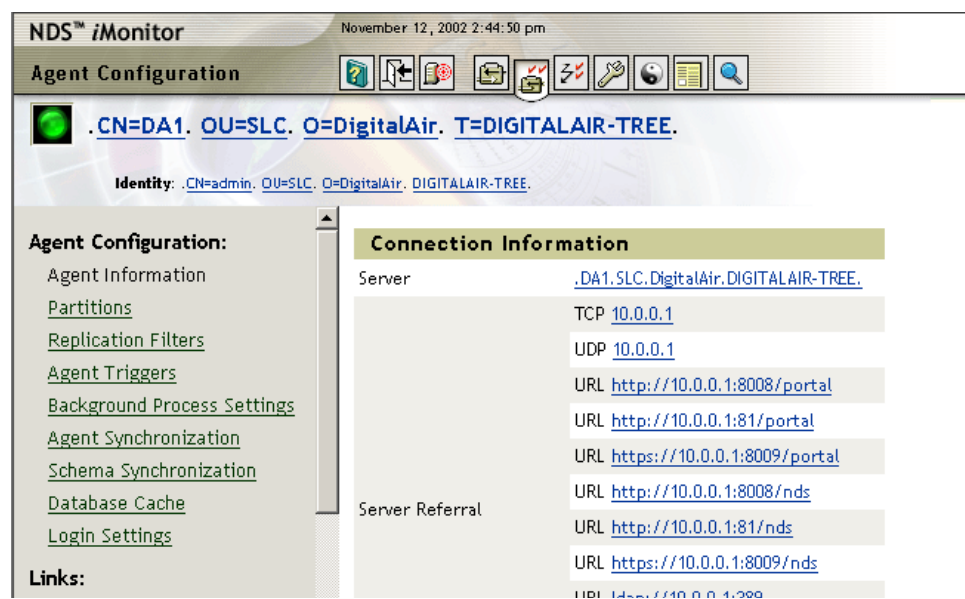
### iMonitor Health Check Procedure

To use iMonitor to perform the health check, do the following:

1. At the left under Links, select **Agent Configuration**.

The following appears:

Figure 3-20



Under Connection Information on the right, you can view important health check information such as the Agent Build Number (DS version) and if Agent Time is synchronized (TRUE or FALSE).

At the left are several options for viewing additional agent configurations and information.

2. At the left under Links, select **Agent Synchronization**; then verify partition synchronization information.

You might want to demonstrate the 2 Agent Synchronization links to make sure students are not confused.



Make sure you don't confuse this link with the Agent Synchronization link located under Agent Configuration.

The following appears:

Figure 3-21

Partition	Errors	Last Successful Sync.	Maximum Ring Delta	Replica's Perishable Data Delta	
<a href="#">.DIGITALAIR-TREE.</a>	2	456:39:43	456:39:36	456:39:36	<a href="#">Replica Synchronization, Agent Health, Change Cach Continuity</a>

The following information is available:

- ❑ **Errors.** Displays the number of errors during synchronization.
- ❑ **Last Successful Sync.** Lists the amount of time since all replicas of the partition were successfully synchronized from this server.
- ❑ **Maximum Ring Delta.** Lists the oldest send delta of any server in the replica ring. This value matches the highest send delta in the replica status list.
- ❑ **Replica's Perishable Data Delta.** Lists the amount of time since this server has last synchronized that partition.

At the right side of the Partition Synchronization Status for your tree, notice the links to Replica Synchronization, Agent Health, Change Cache, and Continuity.

### 3. Select Continuity.

The following appears:

Figure 3-22

The screenshot shows the NDS iMonitor Continuity window. The title bar reads "NDS™ iMonitor" and "November 12, 2002 2:55:08 pm". The Novell logo is in the top right. The main window title is "Continuity". Below the title bar, the tree path is ".CN=DA1. OU=SLC. O=DigitalAir. T=DIGITALAIR-TREE." and the identity is ".CN=admin. OU=SLC. O=DigitalAir. DIGITALAIR-TREE.".

On the left, there is a "Partition List:" section with ".DIGITALAIR-TREE." and a "Links:" section with links to "Agent Summary", "Agent Synchronization", "Known Servers", "Schema", "Agent Configuration", and "Tree Configuration". Below these is a "Replicas:" section listing ".DA1.SLC.DigitalAir.DIGITA" and ".DA2.DEL.DigitalAir.DIGITA".

The main content area displays two tables:

**Ring-wide Partition Synchronization Summary**

Partition	Errors	Last Successful Sync.	Maximum Ring Delta	Replica's Perishable Data Delta
.DIGITALAIR-TREE.	1	456:44:44	456:40:05	456:40:06

**Ring-wide Partition Synchronization Status**

Server	Errors	Last Successful Sync.	Maximum Ring Delta	Replica's Perishable Data Delta	Partition Links	A
.DA1.SLC.DigitalAir.DIGITALAIR-TREE.	2	456:44:44	456:40:05	456:40:06	<a href="#">Replica Synchronization</a> , <a href="#">Agent Health</a> , <a href="#">Change Cache</a> , <a href="#">Continuity</a>	Age

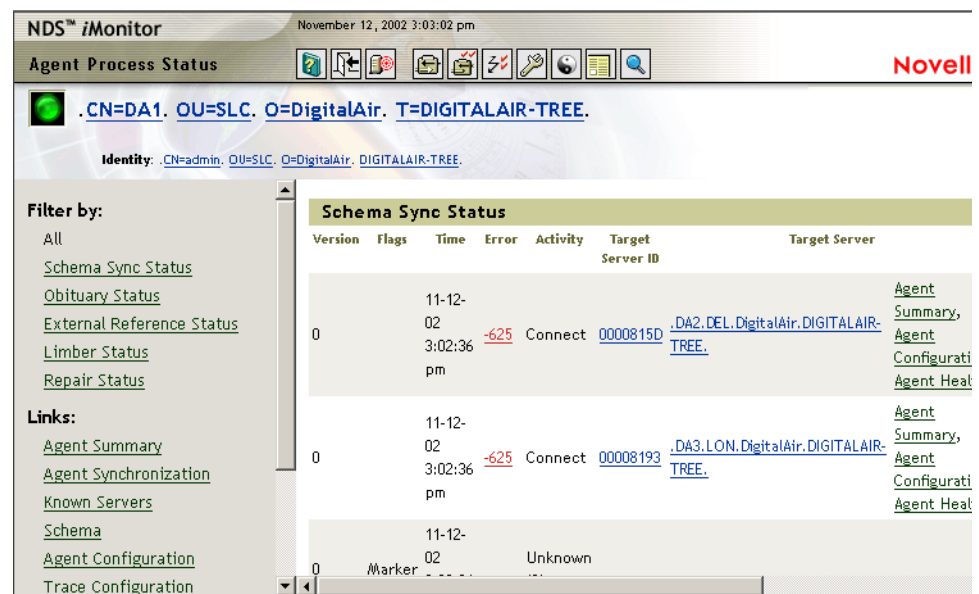
A list of partitions for your eDirectory tree are displayed at the left. When you select a partition, a list of every server that holds a replica of the partition appears at the right.

If a server's replica ring differs from the replica ring maintained by other servers in this list, or if the server cannot participate in the replica synchronization process, an error is displayed.

4. At the left under Links, select **Agent Process Status**.

The following appears:

Figure 3-23



This link lists the following background processes and their status:

- ☐ Schema Sync Status
- ☐ Obituary Status
- ☐ External References Status
- ☐ Limber Status

Any problems with these processes will be displayed with an error code.

### How to Run an Agent Health Report

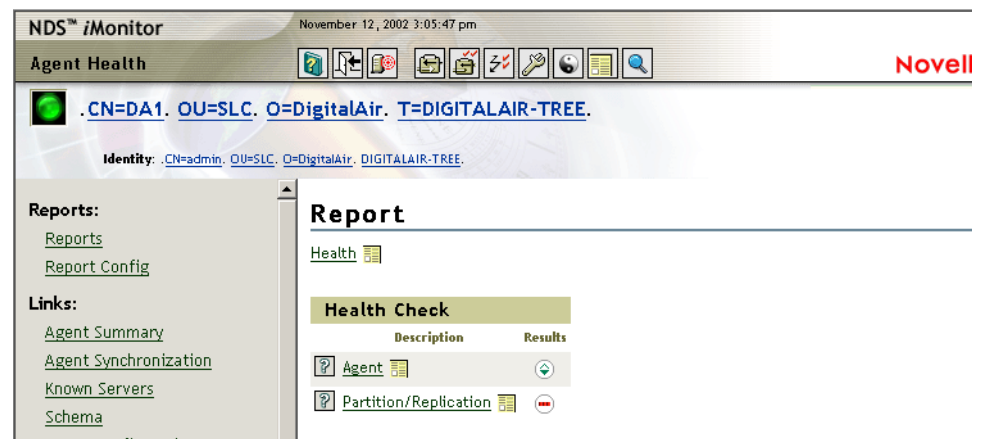
iMonitor has some default reports that you can run. These reports provide quicker access to problems with eDirectory.

Do the following:

1. From iMonitor at the top of the page, select the **Report** icon.
2. Select **Report Config**.
3. From the list of runnable reports, select the option to run the **Agent Health** report.

The report results will display similar to the following:

Figure 3-24

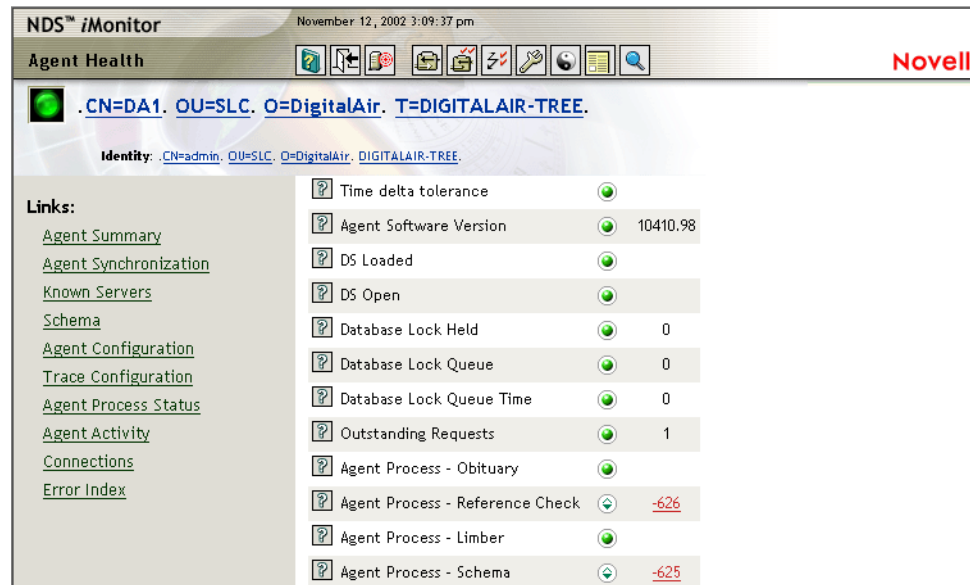


In the above figure, you can immediately see that the report results show problems with both the Agent and Partition/Replication status.

The Agent Results icon indicates that there are marginal problems, and the Partition/Replication processes indicate a warning.

4. When problems exist, you can select the **Agent** link to see the reason for the marginal status as seen in the following:

Figure 3-25



The Health Check Agent displays the processes that are experiencing problems. In this example, 2 error codes are displayed:

- The Agent Process - Reference Check displays error 626.
- The Agent Process - Schema displays error 625.

Selecting the error code displays the help screen with a description of the error and solutions to resolve the errors.

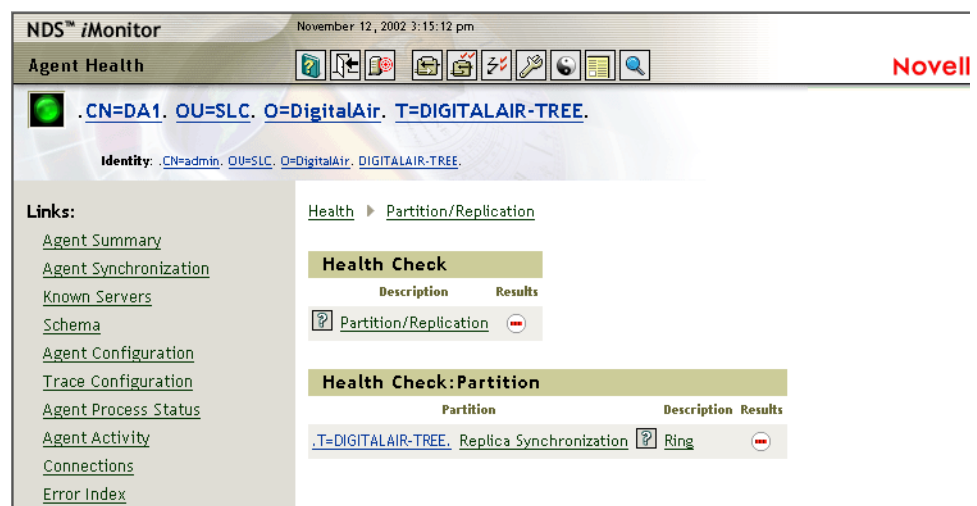
A 626 error lets you know that attempts to connect to the available server have failed. A 625 error tells you that the communication process is not happening, most likely due to a LAN problem.

These errors are not critical at this time, but left unattended, they could cause multiple problems. To identify the full scope of the problem, you should also check the partition and replication errors.

5. Use the **Back** button to return to the report status.
6. Select the **Partition/Replication** link.

If there are no errors, the result area will display a green indicator. In the following, a red dash icon indicates that there is a problem:

Figure 3-26

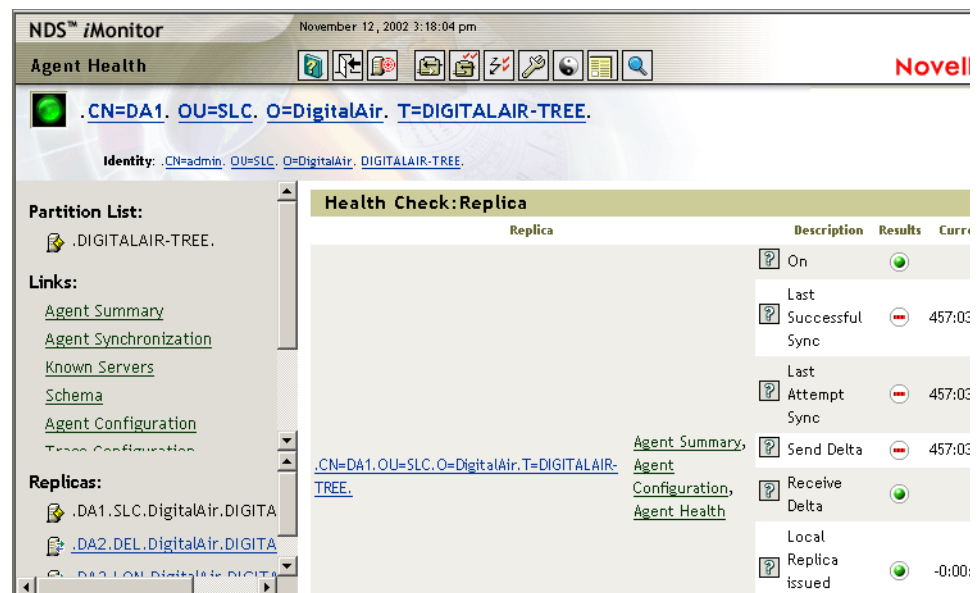


7. To further investigate the problem, select the **Ring** link.



This opens the details for each replica, which indicates that replication is not happening, as shown in the following:

Figure 3-27



8. Select the replica where the error is located.
9. Scroll down to the Partition to view the error.
10. Select the error code again to view the details.

In this example, 694 is a Lost Entry, which indicates that the NDS object being updated using an NDS background process that has not been received.

In the problems displayed in the previous figures, the server DA3 is not accessible by DA1 and updates cannot be processed. To resolve this problem, you would have to access DA3 and perform troubleshooting steps on that server.

**30 minutes**

### ***Exercise 3-3    Verify Your Server and eDirectory Status***

In this exercise, you do the following:

- Part I: Check Your Server Status
- Part II: View Replicas and Partitions
- Part III: Check Schema Synchronization
- Part IV: Complete a Manual Health Check
- Part V: Run the Agent Health Report

Because your tree only includes 1 server, 1 partition, and 1 replica, many of the tasks you perform in this exercise might seem unnecessary.

However, when working with eDirectory in a production environment, these tasks are vital for monitoring and troubleshooting the health of eDirectory and your network.

#### **Part I: Check Your Server Status**

In this part of the exercise, you use iMonitor to view the status of your server.

Do the following:

1. From your desktop, start **Mozilla**; then access iMonitor by entering the following:  
**`https://10.0.0.x:8010/nds.`**
2. Log in as **admin** with a password of **novell**.



---

If you entered your server's DNS name (such as DA3.atl.digitalairlines.com) instead of the IP address, a DHost HTTP Server page might appear. Select NDS iMonitor and log in as admin.

---

3. At the top of the iMonitor window, select the **Home Server Management** icon.

A page is displayed that lets you view statistics and other information about the current status of your server.

4. At the left under Options, select **Connections**.

A list of connections made to your server appears with information about each connection.

5. At the left under Options, select **Statistics**.

A list of processor statistics appears.

6. Select other options and note the information displayed.

Checking this information helps you monitor the health and performance of your server.

7. When you finish, select the icon at the top of the iMonitor window.

You are returned to the iMonitor home page:

Figure 3-28

**NDS™ iMonitor** Wed 17 Dec 2003 08:53:46 AM MST

Agent Summary

**.CN=da4.O=boi.T=DA4-TREE.**

Identity: [.CN=admin.O=boi.DA4-TREE.](#)

**Links:**

- [Agent Synchronization](#)
- [Known Servers](#)
- [Schema](#)
- [Agent Configuration](#)
- [Trace Configuration](#)
- [Agent Health](#)
- [Agent Process Status](#)
- [Agent Activity](#)
- [Connections](#)
- [Error Index](#)

**Partition Synchronization Status**

Partition	Errors	Last Successful Sync.	Maximum Ring Delta
<a href="#">.DA4-TREE.</a>	0	0:10:51	0:00:00

**Servers Known to Database Totals**

Type	Count	Up	Down	Unknown
<a href="#">Known Servers</a>	1	1	0	0
<a href="#">In Replica Ring</a>	1	1	0	0

**Agent Process Status Totals**

Type	Count
<a href="#">All</a>	0

8. (Conditional) If you do not return to the iMonitor home page, enter the following URL:

**<https://10.0.0.x:8010/nds/summary>**

## **Part II: View Replicas and Partitions**

In this part of the exercise, you find out how to use iMonitor to explore the replicas and partitions stored on servers in your tree.

Do the following:

1. At the left under Links, select **Agent Health**; at the right, select **Partition/Replication**.

Notice the circle icon with the red dash. This indicates that there could be a problem with partitioning and replication.

In this case, the icon appears because there is only 1 replica present (a master replica), and Novell recommends 1 master replica and 2 read/write replicas for a healthy replication environment.

2. At the right under Health Check: Partition, select **Replica Synchronization** for DAX-TREE.

On the left, notice the Partition list and the Replicas list; on the right, notice the Partition Synchronization Status and the Replica Status lists.

3. At the left under Replicas, mouse over the server icon to view the replica type.

There is only 1 replica for your tree stored on DAX—a master replica.

eDirectory (by default) only creates 1 master replica and 2 read/write replicas. Because your server was the first server in the tree, it holds the master replica.

If you added a second and third server in the tree, read/write replicas would be assigned to them.

At the left under Partition List, there is only 1 partition that currently exists—the partition for your entire tree.

As you create other partitions (or partitions are created by products such as DirXML), these are also listed.

### Part III: Check Schema Synchronization

In this part of the exercise, you use NDS trace to view the results of a schema synchronization.

Do the following:

1. Under Links, select **Trace Configuration**.

Under the Trace Line Prefixes heading, Time Stamp, Thread ID, and Option Tag are checked by default.

2. At the top of the frame, select **Clear All** to remove unwanted options selected under the DS Trace Options heading.
3. Under DS Trace Options, select **Schema** and **Inbound Synchronization**.
4. From the top of the page, select **Trace On**.
5. At the left under Links, select **Agent Configuration**.
6. At the left under Agent Configuration, select **Agent Triggers**.
7. At the right, select **Schema Synchronization**; then select **Submit**.
8. View the trace for schema synchronization:
  - a. At the left under Links, select **Trace Configuration**.
  - b. At the left under Trace, select **Trace Live**.

Notice that the schema sync started, and any deleted classes or attributes were purged. Also notice that your server has a replica of root (or the eDirectory tree).

9. At the left under Trace, select **Trace Configuration**; then, at the top of the page, select **Trace Off**.

#### **Part IV: Complete a Manual Health Check**

To complete a manual health check of your system, do the following:

1. At the left under Links, select **Agent Configuration**.
2. Record the following information:
  - ☐ Agent Build Number (DS Version):
  - ☐ Current Time:
  - ☐ Time Synchronized (TRUE/FALSE):
  - ☐ Root Most Master (TRUE/FALSE):
3. Under Links, on the left, select **Agent Synchronization**.

What are the number of errors?
4. On the right select **Continuity** for the **DAX-TREE** partition.

Note the information for the Ring-wide partition synchronization.

What are the number of errors?
5. At the left under Links, select **Agent Process Status**.

Notice that the date and time for the Schema Sync Status reflects the schema synchronization you performed.
6. Under Links, select **Agent Synchronization**.
7. At the right under Partition Synchronization Status, select **Replica Synchronization** for the **DAX-TREE** partition.

Notice that the replica is on and is assigned a number of 1.

When was the last time the replica was synchronized?

8. Under the Partition Synchronization Status heading, to the right of **DAx-TREE**, select **Agent Health**.

Review the information.

9. At the top of your browser window, select **Back**; then select **Agent Health** for the Replica Status.

10. Under Health Check, select **Partition/Replication**.

Review the information.

## Part V: Run the Agent Health Report

To automatically perform a health check, do the following:

1. At the top of the iMonitor screen, select the **Reports** icon.  
A message indicates that there are currently no reports running.
2. At the left under Reports, select **Report Config**.
3. At the right under the Runnable Report List heading, select the **Run Report: Agent Health** icon.

When the report is completed, the following screen appears:

Figure 3-29



4. From this screen, evaluate the health of eDirectory by selecting the subreport icon for **Agent** or **Partition/Replication**.
5. When you finish, close the web browser.

*(End of Exercise)*

## Summary

Objective	Summary
1. Describe the Purpose of eDirectory	<p>To describe the purpose of eDirectory, you need to know the following:</p> <ul style="list-style-type: none"><li>■ <b>What a Full-Service Directory Provides</b> A full-service Directory is a database that provides features such as discovery, security, storage, and relationship management.</li><li>■ <b>The Role of eDirectory.</b> eDirectory provides the basic foundation for Directory services and the following benefits:<ul style="list-style-type: none"><li>■ Central management of network information, resources, and services</li><li>■ A standard method of managing, viewing, and accessing network information, resources, and services</li><li>■ A logical organization of network resources that is independent of the physical characteristics or layout of the network</li><li>■ Dynamic mapping between an object and the physical resource it refers to</li></ul></li></ul>

---



Objective	Summary
2. Describe How eDirectory Works	<p>To describe how eDirectory works, you need to know the following:</p> <ul style="list-style-type: none"><li>■ <b>eDirectory Tree Architecture</b><p>The eDirectory tree is a hierarchical structure that includes the tree object and container objects.</p><p>The top of the tree is called the <i>tree object</i>. <i>Container objects</i>, like folders in a file system, are placed in the tree object or in other containers. (A container object is called a <i>parent object</i> if it contains other objects.)</p><p><i>Leaf objects</i>, like files stored in folders, are placed within containers.</p></li><li>■ <b>How eDirectory Uses Foundation Services</b><p>eDirectory relies on a foundation of error-free communications, accurate time synchronization, and efficient replica synchronization.</p><p>To understand how these foundation services help keep eDirectory running smoothly, you need to know the following:</p><ul style="list-style-type: none"><li>■ SLP and eDirectory</li><li>■ Time Synchronization and eDirectory</li><li>■ Partitions and Replication in eDirectory</li></ul><p>In addition, you should also understand the following to effectively utilize eDirectory in a Linux environment:</p><ul style="list-style-type: none"><li>■ Transport Layer Security (TLS)</li></ul></li></ul>

Objective	Summary
2. Describe How eDirectory Works (continued)	<ul style="list-style-type: none"><li>■ <b>eDirectory and LDAP</b> LDAP is an Internet communications protocol that lets client applications access directory information.  To understand eDirectory and LDAP, you need to know the following:<ul style="list-style-type: none"><li>■ Records and Attributes</li><li>■ LDAP Naming Contexts and eDirectory Partitions</li><li>■ Novell LDAP Server Object</li><li>■ Novell LDAP Group Object</li><li>■ How LDAP Clients Bind to eDirectory</li><li>■ LDAP Data Interchange Format (LDIF)</li></ul></li></ul>

---

Objective	Summary
3. Perform eDirectory Administration Tasks	<p>To perform administration tasks for eDirectory on Linux, you need to know the following:</p> <ul style="list-style-type: none"><li>■ <b>Command Line Utilities</b><p>The following command line utilities are available to help you with eDirectory management, monitoring, and troubleshooting tasks:</p><ul style="list-style-type: none"><li>■ <code>ldapconfig</code></li><li>■ <code>ndsbackup</code></li><li>■ <code>ndsconfig</code></li><li>■ <code>ndsmonitor</code></li><li>■ <code>ndslogin</code></li><li>■ <code>ndsmerge</code></li><li>■ <code>ndsrepair</code></li><li>■ <code>ndsstat</code></li><li>■ <code>ndstrace</code></li><li>■ <code>nmasinst</code></li></ul></li><li>■ <b>How to Start and Stop eDirectory on Linux</b><p>You can stop eDirectory at a shell prompt by entering <code>./ndsd stop</code> from the <code>/etc/rc.d/init.d</code> or <code>/etc/init.d</code> directory. You can enter <code>./ndsd start</code> from the same directory to start eDirectory.</p></li><li>■ <b>Novell iManager</b><p>Novell iManager provides a Web-based management tool that uses roles to delegate eDirectory administration, management, and services tasks.</p></li></ul>

---

Objective	Summary
3. Perform eDirectory Administration Tasks (continued)	<ul style="list-style-type: none"><li>■ <b>Novell iMonitor</b> Novell iMonitor gives you monitoring and diagnostic capability on all servers in your eDirectory tree.</li><li>■ <b>How to Perform a Health Check in iMonitor</b> To understand how to perform a health check, you need to know the following:<ul style="list-style-type: none"><li>■ Why Health Checks Are Necessary</li><li>■ When and How Often Health Checks Are Needed</li><li>■ Health Check Elements</li><li>■ iMonitor Health Check Procedure</li><li>■ How to Run an Agent Health Report</li></ul></li></ul>

---

## **SECTION 4     Manage User Identities with NNLS**

In this section you review the tools and services available in Novell® Nterprise™ Linux® Services (NNLS) to help you view and manage user identities.

### **Objectives**

1. Manage User Objects with iManager
2. View User Information with eGuide
3. Access a Linux Server with Linux User Management (LUM)

### **Objective 1     Manage User Objects with iManager**

To manage user objects on your NNLS server with iManager, you need to know the following:

- How to Create User Objects
- How to Modify User Objects
- How to Move Objects
- How to Delete User Objects
- How to Extend the eDirectory Schema with an Auxiliary Class

### *How to Create User Objects*

To create a user object (account) in eDirectory™ using iManager, do the following:

1. From a web browser, access and log in to iManager.
2. At the left under Users, select **Create User**.

The following Create User page appears:

**Figure 4-1**

The starred fields are required in order to create a user object.

3. (Required) Enter a *username* and *last name*.

The Username field contains the name of the user object and is used in the login process. The last name appears in the Last Name field of the user object properties.

4. (Required) Enter a *context* for the user object.

This is the organizational container or organizational unit container where you will find the user object.

You can select the magnifying lens icon (object locator) to the right of the field to search for and select the container.

5. (Optional) Indicate if you want to use a template.

A template object contains defined property values that can be applied to any user associated with the template. The template object is discussed later.

6. (Optional, but recommended) Enter a *password*.

If you do not enter a password now, anyone can access the user object without a password.

7. (Optional) Enter any other information (such as Title or Department).

8. Create the user by selecting **OK**.

A message appears, indicating that the creation was successful.

9. Select **OK**.

10. Verify that the object was created by selecting **Modify User** and selecting the magnifying glass icon; then browse to and select the new user.

11. You can view or modify any of the user object properties by selecting **OK**.

12. When you finish, select **OK**.



---

When creating a user, you can copy attributes from another User object, or use an existing User Template object created in ConsoleOne®.

---

### ***How to Modify User Objects***

To modify a user object in eDirectory using iManager, do the following

1. From a web browser, access and log in to iManager.
2. At the left under Users, select **Modify User**.
3. Browse to and select the eDirectory user object you want to modify; then select **OK**.

The following Modify User page appears:

**Figure 4-2**

**Novell iManager**  
Unrestricted Access

User: admin.SLC.DA.DA-TREE

[View Effective Rights](#)

**Schema**  
[Add Attribute](#)  
[Attribute Information](#)  
[Class Information](#)  
[Create Attribute](#)  
[Create Class](#)  
[Delete Attribute](#)  
[Delete Class](#)  
[Object Extensions](#)

**SNMP**  
[Create Object](#)  
[Delete Object](#)  
[SNMP Overview](#)

**Users**  
[Create User](#)  
[Delete User](#)  
[Disable Account](#)  
[Enable Account](#)  
[Modify User](#)

**Virtual Office Management**  
[Services Administration](#)  
[Environment Administration](#)

**WAN Traffic**  
[Create LAN Area](#)  
[Delete LAN Area](#)  
[WAN Traffic Management Schema](#)  
[WAN Traffic Manager Overview](#)

**Modify User: KTracy**  
General

First name: Kimberly

Last name: Tracy

Full name: Kimberly Tracy

Generational qualifier:

Middle initial:

Other name:

Title: General Manager

Location: Salt Lake City

Department: Administration

Telephone number: 555-1234

Fax number: 555-1235

E-mail address:

Description:

OK Cancel Apply

A drop-down list at the top of the page lets you select from several configuration pages.

4. Select a page from the drop-down list; then make changes in the appropriate fields.
5. When you finish, save the changes by selecting **OK**.



### ***How to Move Objects***

Using iManager, you can move objects from 1 container to another.

When you move an object, the object's information moves with it. The object's information is also modified and updated to reflect the object's new location.

For example, suppose a Digital Airlines employee relocates from the Salt Lake City office to the Sydney office.

You need to move the employee's user object from the SLC container to the SYD container to provide local authentication instead of having the user authenticate over a WAN link.

However, the user still needs access to all applications and files he's been using.

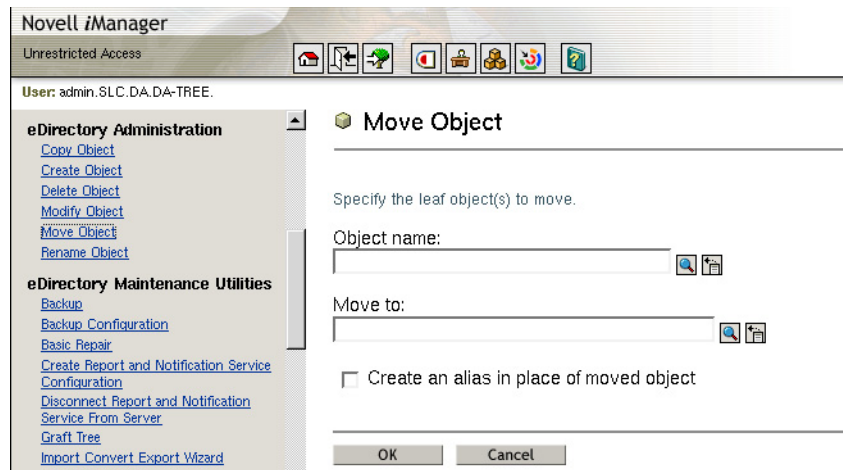
By moving the user object to a different container, the user retains his group memberships and network access, but the user can log in to the network in his location.

To move an object in iManager, do the following:

1. From iManager at the left under eDirectory Administration, select **Move Object**.

The following appears:

Figure 4-3



2. Enter the object name and the location (container) where you want to move the object.

You can use the magnifying glass icon to browse to and select these values. You can also select **Select multiple objects** to move more than 1 object at a time (Internet Explorer only).

3. (Optional) If you want to create an alias in the old location for each object being moved, select **Create an alias in place of moved object**.

This allows any operations that are dependent on the old location to continue uninterrupted until you can update those operations to reflect the new location.

4. Move the object by selecting **OK**.

### ***How to Delete User Objects***

In addition to creating, modifying, and moving user objects, you can also delete them. Deleting a user object is serious, so make sure the object will never be used again.



---

To avoid permanent deletion, disable the user object rather than delete it.

---

If you delete a user object, you can re-create it using the same user name; however, the new user object will have a different Global User ID (GUID) number than the previous user object, because the GUID number associated with the original user object was also deleted.

This is important because rights assigned to a user are actually assigned to the GUID number of the user object and not the user name of the user object.

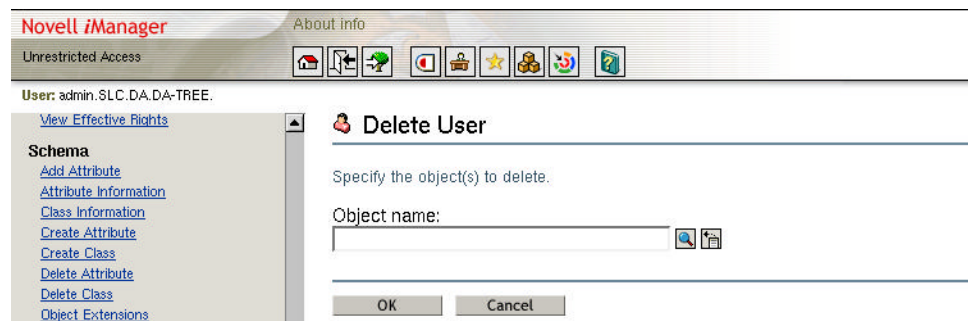
If you delete a user object and then have to recreate another user object for the same employee, you must also manually assign eDirectory and file system rights to the user before he or she can begin working.

To delete a user object in iManager, do the following:

1. At the left under Users, select **Delete User**.

The following appears:

Figure 4-4



2. Browse to and select the user object you want to delete; then select **OK**.
3. Confirm the deletion by selecting **Yes**.

**20 minutes**

### **Exercise 4-1    Manage User Objects**

Students must complete all parts of this exercise. The ACCTUSERS group and the 4 users created here are used in Exercise 6-5.

As a network administrator for your Digital Airlines office, you are responsible for creating and modifying employee user accounts in eDirectory.

The following employees were hired and need user accounts in eDirectory:

- Bret Grow
- Kate Bailey
- Janet Nelson
- Jack Goldman

Do the following:

- Part I: Create a Group Object
- Part II: Create User Objects
- Part III: Modify a User Object
- Part IV: Create a User from Another User Object

#### **Part I: Create a Group Object**

Create an ACCTUSERS group object by doing the following:

1. From your NNLS server desktop, open Mozilla and access iManager by entering the following URL:  
**`https://DAX.your_container.DigitalAirlines.com/nps/iManager`**
2. (Conditional) If you received any messages, select **Continue** or **OK** to proceed.

A Login page appears.

3. Log in to iManager as **admin** with a password of **novell**.  
A list of roles and tasks appears to the left.
4. At the left under **eDirectory Administration**, select **Create Object**.
5. In the Available object classes window, select **Group**; then select **OK**.
6. Enter the following:
  - ❑ Group name: **ACCTUSERS**
  - ❑ Context: ***your container***
7. Select **OK**.  
A message indicates that creation was successful.
8. Select **OK**.
9. Convert this to a LUM group by selecting **Linux Workstations**.
10. Browse to ***your container*** and select **UNIX Workstation - DAX**.
11. Select **OK**.  
A message indicates the LUM group was successfully created.
12. Select **OK**.

## Part II: Create User Objects

From your NNLS server, create user objects for Kate Bailey and Bret Grow using the information in the following and the steps below:

Table 4-1

Property	Kate Bailey	Bret Grow
<b>Username</b>	KBailey	BGrow
<b>First name</b>	Kate	Bret
<b>Last name</b>	Bailey	Grow

**Table 4-1** *(continued)*

Property	Kate Bailey	Bret Grow
<b>Context</b>	<i>o=your container</i>	<i>o=your container</i>
<b>Password</b>	novell	novell

1. At the left under **Users**, select **Create User**.
2. Enter the **username**, **first name**, **last name**, **context**, and **password** for Kate Bailey from Table 4-1 in the appropriate fields; then scroll down and select **OK**.



Instead of entering the context, you can select the magnifying glass icon; then browse to and select the appropriate container.

A message indicates that creation was successful.

3. Select **OK**.
4. Enter a primary group to convert this user to a LUM user by browsing to and selecting the **ACCTUSERS** group in *your container*.

5. Deselect **Also convert this user to a Samba user object**.

Samba is discussed in Section 6.

6. Select **OK**.

A message indicates that the LUM user has been successfully created.

7. Select **OK**.
8. Repeat these steps for **Bret Grow**.

### Part III: Modify a User Object

Do the following:

1. At the left under **Users**, select **Modify User**.
2. At the right, enter or browse to and select **KBailey.your container**; then select **OK**.
3. Enter the following in the specified properties for KBailey:

Table 4-2

Property	Value
Full Name	Kate Bailey
Title	Office Manager
Telephone Number	555-7878 555-4321

To enter a value, select the plus sign icon to the right of the field, enter the value, and select **OK**.

4. Save the changes by selecting **OK**.

### Part IV: Create a User from Another User Object

In this part of the exercise, you create a user object for a temporary employee (JNelson), and then use JNelson's user object to create a user object for a second temporary employee (JGoldman).

Do the following:

1. Create a user object for **Janet Nelson** using the following information:

Table 4-3

Property	Value
Username	JNelson



**Table 4-3**

Property	Value
First name	<b>Janet</b>
Last name	<b>Nelson</b>
Context	<i><b>your container</b></i>
Password	<b>novell</b>
Primary Group for LUM	<b>ACCTUSERS.your container</b>
Samba User	<b>Deselect</b>
Full Name	<b>Janet Nelson</b>
Title	<b>Temp Worker</b>
Telephone Number	<b>555-4321</b>
E-mail Address	<b>JNelson@your container.digitalairlines.com</b>

Entering all the information for Janet Nelson requires that you use both the Create User and the Modify User options.

2. After you have successfully created the JNelson user object, create a user object for **Jack Goldman** by copying information from the JNelson user object:
  - a. At the left under **Users**, select **Create User**.
  - b. Enter the following information:
    - Username: **JGoldman**
    - First name: **Jack**
    - Last name: **Goldman**
    - Context: ***your container***
    - Password: **novell**
  - c. Select **Copy from template or user object**.
  - d. Browse to and select or enter **JNelson.your container**.
  - e. Create the JGoldman user object by selecting **OK**.

- f. Make JGoldman a **LUM user** with **ACCTUSERS.your container** as the primary group.
  - g. **Deselect** the option to make this user a Samba user.
  - h. Select **OK**.
3. View the properties of the JGoldman user object by selecting **Modify User**, browsing to and selecting the object, and then selecting **OK**.
- Although the Title and Telephone number are correct, you need to modify the Full Name and E-mail address properties.
4. Edit the information in these fields by selecting the pencil icon; then change it to the following:
- Full Name: **Jack Goldman**
  - E-mail address: **JGoldman@your container.digitalairlines.com**
5. When you finish, save the changes by selecting **OK**.
6. Close the Mozilla browser window.

*(End of Exercise)*

### ***How to Extend the eDirectory Schema with an Auxiliary Class***

As you manage users in eDirectory, you might need to add employee information (such as a license plate number) that doesn't have a corresponding field.

You can add other fields to user objects in eDirectory by extending the schema. We recommend doing this by creating an auxiliary class (the safest method).

To extend the eDirectory schema with an auxiliary class, you need to know the following:

- What the Schema Is
- Schema Management Options in iManager
- How to View the Schema
- How to Create an Auxiliary Class

### **What the Schema Is**

The eDirectory schema defines the classes of objects that the tree can contain, such as users, groups, and printers.

The schema also specifies the attributes (properties) that comprise each object type, including those that are required when creating the object and those that are optional.

You can view the schema to evaluate how well the schema meets your organization's informational needs, and then extend the eDirectory schema to meet your organization's needs.

The larger and more complex your organization, the more likely it is that you need to customize the schema, but even small organizations might have unique tracking needs.

For example, if your company has started to use temporary employees, you can extend the schema to create a temporary employees class.

You then use the new class to create temporary employee user objects.

## Schema Management Options in iManager

The Schema role in iManager allows users with the Supervisor right to a tree to customize the schema of that tree.

You can use the Schema management options to

- View a list of all classes and attributes in the schema
- Extend the schema by adding a class or an attribute to the existing schema
- Create a class by naming it and specifying applicable attributes, flags, and containers that can be added to, and parent classes it can inherit attributes from
- Create an attribute by naming it and specifying its syntax and flags
- Add an attribute to an existing class
- Delete a class or an attribute that is not in use or that has become obsolete
- Identify and resolve potential problems

## How to View the Schema

Viewing the schema can help you determine if you need to extend the base schema.

In iManager, do the following:

1. At the left under **Schema**, select **Attribute Information** or **Class Information**.
2. From the drop-down list, select an attribute or class; then select **View**.

By selecting a class, you can view all the attributes associated with that class.

3. When you finish, select **Close**.

### How to Create an Auxiliary Class

An auxiliary class is a set of properties (attributes) that is added to particular eDirectory object instances rather than to an entire class of objects.

For example, an email application could extend the schema of your eDirectory tree to include an E-Mail Properties auxiliary class and then modify individual objects with those properties as needed.

A network administrator might also need to extend the schema by creating an auxiliary class to include properties that are not part of the base schema for User objects.

Some examples of this include the following:

- Your company provides uniforms for many of its workers, so shirt and pant sizes are needed in eDirectory.
- Your school wants to keep track of locker numbers and combinations for each student in eDirectory.

With Schema Manager, you can define your own auxiliary classes. You can then extend individual objects with the properties defined in your auxiliary classes.



---

You need the Supervisor right to the entire tree to extend the schema.

---

From iManager, do the following:

1. At the left under **Schema**, select **Create Class**.
2. Follow the instructions in the wizard to define the auxiliary class.  
Make sure to select Auxiliary Class when setting the class flags.  
If you need to define custom properties to add to the auxiliary class, cancel the wizard and define the custom properties first.
3. In iManager, use the **Object Extensions** option to assign the auxiliary class to an object; then enter data for the class.
4. In iManager, use the **Modify Object** option to access the object's Other page and verify that the class and the data were added.



---

The Other page cannot be accessed if you use the Modify User option.

---

**12 minutes**

### ***Exercise 4-2    Create an Auxiliary Class***

Digital Airlines has started to issue 2-way radios to its Flight Operations employees.

You choose to extend the eDirectory schema by creating an auxiliary class (named **Radios**) that lets you keep track of the serial numbers of the 2-way radios issued to the employees.

Do the following:

1. Open Mozilla and access iManager by entering the following URL:

**`https://DAX.your container.DigitalAirlines.com/nps/iManager`**

2. Log in to iManager as **admin** with a password of **novell**.
3. From iManager under **Schema**, select **Create Class**.  
The Step 1 page of the Create Class Wizard appears.
4. In the Class name field, enter **Radios**.
5. Leave the ASN1 ID field blank; then select **Next**.
6. Select **Auxiliary Class**; then select **Next**.
7. In the Step 3 page, select **Next**.
8. Define a mandatory attribute for the Radios auxiliary class:
  - a. From the Available attributes list, select **Serial Number**.
  - b. Move the Serial Number attribute to the Mandatory attributes list by selecting the **right arrow**.
  - c. Select **Next**.
9. In the Step 5 page, select **Next**.
10. In the Step 6 page, select **Next**.
11. Review the summary of your new auxiliary class.
12. Select **Finish**; then select **OK**.

**13.** Assign the Radios auxiliary class to a user object in *your container*:

- a. On the left under **Schema**, select **Object Extensions**.
- b. Browse to and select or enter a user from *your container*; then select **OK**.
- c. Select **Add**.
- d. Select **Radios**; then select **OK**.
- e. For the serial number, select the + button and enter **2WR12345**; then select **OK**.
- f. Select **OK**.  
A message indicates that the change was successful.
- g. Select **OK**.
- h. Verify that **Radios** is listed as a current auxiliary class extension; then select **Close**.

**14.** Verify that the data you entered was added to the user:

- a. At the left under **eDirectory Administration**, select **Modify Object**.



---

You must use the Modify Object option in this case because you need to access the Other tab. The Other tab cannot be accessed from the Modify User option.

---

- b. Browse to and select or enter the name of the user you modified in *your container*; then select **OK**.
- c. From the drop-down list at the top of the page, select **General: Other**.  
The Serial Number attribute appears in the Valued Attributes list.
- d. Select **Serial Number**; then select **Edit**.  
A window appears with the serial number displayed.
- e. Close the window by selecting **Cancel**.



15. Exit iManager by selecting the **Exit** icon (top of the page); then close the browser window.

*(End of Exercise)*

## Objective 2    View User Information with eGuide

eGuide is a Web application that lets you search for and view information about people, places, and things stored in eDirectory and other LDAP data sources at the same time.

eGuide looks like an address book and can be accessed by any user with rights to your Web server via a standard Web browser.

To view user information with eGuide, you need to know the following:

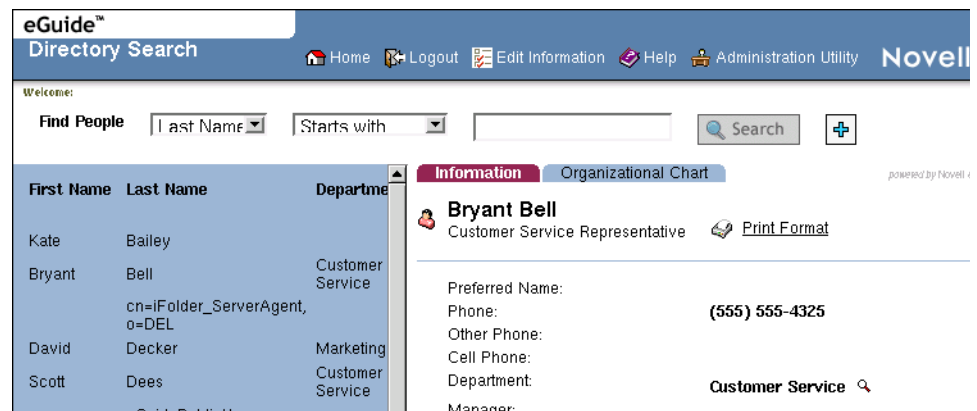
- The Features of eGuide
- How to Access the eGuide Client
- How to Configure eGuide for LDAP

### *The Features of eGuide*

eGuide is independent of platform or a particular application. It can be accessed by any user with rights to your Web server via a standard Web browser.

The following shows the main page of eGuide:

Figure 4-5



In addition to searching Novell eDirectory, you can use eGuide to search other LDAP data sources at the same time.

For example, if your company purchases another company, you can easily provide a combined white pages view of both companies by pointing eGuide at 2 separate directories at the same time.

eGuide runs on the most widely used platforms and is compatible with e-mail, instant messaging, and real-time collaboration tools, such as Microsoft® NetMeeting or AOL Instant Messenger<sup>SM</sup>.

When you find a person you are looking for in eGuide, you can launch whatever type of communication that fits your need—email, instant messaging, and even video conferencing.

The major features of eGuide are described below:

- Standards-based display and administration with HTML, XML, and XSL make configuration and use simple, convenient, and highly customizable.
- Advanced Search capabilities allow searches on any attribute.

- Data handler controls allow you to display the information the way you want.
- Organizational Charts are automatically generated based on eDirectory attributes.
- Anonymous and User Authentication modes are supported, including contextless login, cookies, and support for eDirectory password restrictions.
- Authenticated Searching utilizes access control lists in eDirectory to determine if a user can access particular attribute information, such as home phone numbers.
- eGuide works seamlessly with Novell iChain® and Novell Portal Services. eGuide is also an excellent add-on to DirXML® synchronization projects.
- eGuide is compatible with eDirectory or any other LDAP-enabled directory service.

### ***How to Access the eGuide Client***

There are 2 ways to access eGuide:

- **From the Administration utility.** If you are in the Home page of the Administration Utility, you can select the **Launch eGuide Client** icon to access the eGuide client.
- **From the eGuide URL.** To access the eGuide client at any other time, point your browser to the following URL:

**`https://web_server/eGuide`**

Replace ***web\_server*** with the hostname or IP address of the web server where you installed eGuide.

### ***How to Configure eGuide for LDAP***

eGuide is an LDAP client application. It can target data in eDirectory and other LDAP-compliant data sources.

The process of configuring eGuide involves identifying the LDAP data source and specifying how eGuide will access that data source.

To understand how this connection is configured, you need to know the following:

- **Anonymous bind.** A feature of LDAP servers is the ability to access data using an Anonymous bind.

With eDirectory, Anonymous users have the rights assigned to either the pseudo object named [Public] or the rights of an LDAP Proxy user object.

By default, Anonymous has the same rights to objects in the directory as [Public]. When a tree is created, [Public] is granted “browse” rights to the root of the tree. However, no “read” rights are assigned.

eGuide performs its function primarily using LDAP search operations. Search operations require read rights to the attribute being searched.

To remedy this, you can use iManager to specify [Public] as trustee to sections of the tree with specific rights for objects and attributes of those objects.

- **eGuide proxy user.** Instead of specifying [Public] as a trustee, you can create an eGuide Proxy user, and make it a trustee for a portion of the tree with read and write rights for objects and attributes of those objects.

The eGuide proxy user serves the same function as the LDAP proxy user except that an LDAP proxy applies to all LDAP anonymous binds, and the eGuide proxy user is unique to the eGuide application.

- **Secure connections (TLS).** Another piece of information you need about the target LDAP system is how it handles secure connections.

If the LDAP service is configured to use a secure connection, you must enable eGuide to also use a secure connection. This is done by selecting the Enable SSL option in the eGuide Quick Setup wizard.

eDirectory 8.7.3 uses Transport Layer Security or TLS to provide a secure LDAP connection. TLS is an open source implementation of Secure Socket Layer (SSL).



For details on how to configure eGuide to access data from LDAP sources, see the Novell eGuide Administration Guide at <http://www.novell.com/documentation/a-z.html>.

---

**15 minutes**

### ***Exercise 4-3 Set Up and Access eGuide***

In this exercise, you do the following:

- Part I: Access eGuide to View Digital Airlines Employees
- Part II: Configure eGuide for Users

#### **Part I: Access eGuide to View Digital Airlines Employees**

With eGuide configured, you are ready to access the eGuide client.

Do the following:

1. From your NNLS server desktop, launch **Mozilla**; then enter the following URL:

**`https://DAX.your_container.DigitalAirlines.com/eGuide`**

An eGuide login page appears.

2. Log in to eGuide as **admin** with a password of **novell**.

After a few moments, the eGuide Directory Search page appears.



---

If login fails, try entering **cn=admin.o=your\_container** for the username.

---

3. Select **Search** at the top of the page to list all the employees that have user objects in your tree.

All the employees are listed to the left.

The blank line at the top of the list represents your admin object.

4. Select an employee to view the employee's information (stored in eDirectory).

(Optional) Have students access eGuide from Internet Explorer on the Microsoft Windows™ machine. They will see that it looks better in IE.



---

Selecting the Organizational Chart tab does not display the expected results because the user objects have not been set up with the correct information.

---

5. While logged in as admin, edit the admin information and give the admin entry a first name:
  - a. At the top of the eGuide page, select **Edit Information**.
  - b. In the First Name field, enter **Admin**.
  - c. Scroll down and select **Save**.
  - d. Select the **Admin entry** (which is the top row and is still blank).

Notice the **Edit Information** link associated with the Admin entry (not the link on the eGuide menu bar).

- e. Select **any other user** in the list and notice that there is no edit information link.
6. Try limiting the list of employees displayed by using the Find options at the top of the page. For example, do the following:
  - a. From the Find People drop-down list (top of page), select **First Name**.
  - b. For the first name, enter **J**; then select **Search**.
7. On the top of the page (on the eGuide menu bar), select **Edit Information**.

What employee can you edit information for?

Notice that you can only edit information for Admin (who you are logged in as). Any information you edit here is saved with the user object in eDirectory.
8. Change the Find People drop-down option to **Last Name**.
9. From the entry field, delete the **J**; then select **Search**.
10. Notice that the entire list of users now shows an **Admin** entry at the top of the list.

Also notice that the Administration Utility is available (top of page) because you are logged in as Admin.

11. At the top of the page, select **Logout**.

A successfully logged-out page appears.

12. Select **Return to Novell eGuide**.

13. Log in as another user with a **novell** password.



---

If the login fails, try entering **cn=username, o=your container** for the username.

---

Is the Administration Utility still available?

Because the user is not configured as an administrator for eGuide, the Administration Utility link is not available.

14. Select **Search**.

The list of employees is displayed along with available employee information.

15. Scroll through the employee list (press the right arrow if necessary) to find and select **the user** you logged in as.

Notice that you can view the user's information.

16. Select **Edit Information**.

You can also edit the user's information.



---

Edits made at this point might not be saved since RBS is not configured.

---

## Part II: Configure eGuide for Users

Do the following:

1. Log out of eGuide; then log in as **admin**.



2. At the top of the page, select **Administration Utility**.  
The eGuide Administration Utility page appears.
3. At the left under **Configuration**, select **LDAP Data Sources**.  
An LDAP Data Sources list appears with a `New_Data_Source` listed.
4. At the right under **Properties** for `New_Data_Source`, select **Edit**.  
A `New_Data_Source` properties page appears with 3 tabs: LDAP Settings, Attributes, and Advanced.  
Notice that the LDAP data source for `New_Data_Source` is your server (such as DA3 (10.0.0.3)). This means that eGuide is accessing the employee information from the eDirectory database for your tree stored on your server.
5. Select the **Attributes** tab.  
A list appears of LDAP attributes available to eGuide for user objects. You can enable an attribute for searching or editing.
6. Scroll down to **title**; then select **Searchable**.
7. Scroll to the bottom of the list; then select **Save**.  
A “Your information has been saved!” message appears at the top of the list.
8. Under Display on the left, select **Skins**, and select another skin for eGuide (such as **Cool-Blue**); then select **Save**.  
A “Modification successful!” message appears at the top of the page.
9. At the top of the page, select the **Launch eGuide client** icon.  
You are returned to the eGuide client home page.  
Notice the skin has changed to reflect your configuration.

10. From the Find People drop-down list (top of the page), select **Title** and enter **pilot**; then select **Search**.

The results appear to the left.

11. Select **Logout**; then close the Mozilla browser.

*(End of Exercise)*

### Objective 3      **Access a Linux Server with Linux User Management (LUM)**

Linux User Management (LUM) is a Novell eDirectory-based service for Linux systems that allows Linux users to leverage eDirectory as a user account management solution.

To use LUM to manage user accounts, you need to know the following:

- What LUM Is
- LUM Components
- eDirectory LUM Objects
- User Accounts
- Group Accounts
- How to Configure LUM
- How to Perform Basic LUM Tasks

### ***What LUM Is***

Normally Linux users authenticate against information stored in a `passwd` file on the Linux server. This authentication gives them specific rights to Linux services.

LUM lets eDirectory users authenticate against their object in the tree for access to Linux services without having to have an entry in the `passwd` file.

With LUM you can modify or create eDirectory users and groups that can then access the NNLS server. This is required if either of the following scenarios apply to your NNLS implementation:

- You want users who are accessing PAM-enabled services on the Linux server, such as login or ftp, to authenticate through eDirectory.
- You need to provide Samba share-based file services on the NNLS server to Windows users on your network.

The fact that you are very likely to encounter one or both of these scenarios when implementing NNLS emphasizes that LUM is a key component of NNLS.

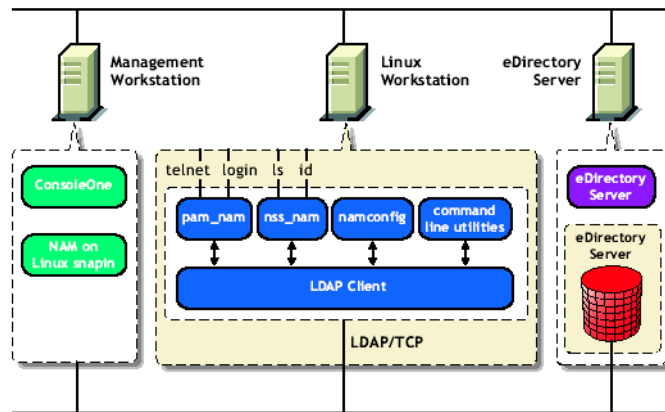
LUM works with Novell Account Management (NAM) implementations to simplify the complexities of mixed networks by unifying the management of user profiles in eDirectory.

LUM does not create special user or group objects in eDirectory. It simply extends the schema for user and group objects with LUM properties and data.

## LUM Components

The following figure provides an overview of the LUM components that enable eDirectory user profile management:

Figure 4-6



Each component is described below:

- **pam\_nam:** Provides authentication, account, session, and password services for all PAM-enabled applications on the NNLS server.

After authenticating to eDirectory, users have the same privileges and rights as they have when authenticating to NIS, NIS+, or local files.

The user profile provides rights to file and print services and the preferred Linux shell.

- **nss\_nam:** A Name Switch Service (NSS) redirector that enables user access to system resources by checking user profiles against access rights.

- **namconfig:** Lets you add or remove LUM from a specified eDirectory context and retrieve or set LUM configuration parameters.

You can also use namconfig to import the SSL certificate into the local machine.

- **Command line utilities:** LUM provides command line utilities for manipulating user and group accounts.

### ***eDirectory LUM Objects***

Linux users, groups, and workstations are represented by objects in the eDirectory tree.

LUM deals with 5 types of eDirectory objects:

- **User.** LUM extends the schema of the user object to store Linux attributes.

A user object can belong to several groups. However, it must belong to at least 1 default or primary group.

- **Group.** LUM extends the schema of the group object to store Linux attributes.

A group object can belong to 1 or more Linux servers or workstations.

- **Linux Workstation.** This object stores information about access control to the server or workstation and other details required for LUM operations.

- **Linux Config.** This object stores LUM configuration information for a specific LUM domain.

A LUM domain usually consists of Linux workstations that use eDirectory for account management.

The Linux Config object stores attributes such as Linux workstation contexts and so on.

- **Template.** This object facilitates the creation of new users who share certain common requirements.

### ***User Accounts***

User accounts grant access to a system. The level of access assigned to an account determines the privileges the account holder has on the system. User accounts insulate users from each other and allow users to customize their environment.

Each Linux user account is identified by a unique user name (also called login name or User ID).

### ***Group Accounts***

Users are classified into groups to simplify access control to the system. Every user belongs to 1 or more groups and receives all the privileges that are assigned to the group.

Every user must belong to at least 1 default group, the primary group.

Each group is identified by a group name and a Group ID.

A group does not have to be assigned to a workstation. It can, however, be assigned to 1 or more workstations. The group object stores a list of users it contains as well as a list of workstations to which it belongs.

### ***How to Configure LUM***

As part of the installation process, basic configuration parameters are set that allow LUM to work.

However, you might need to configure LUM after the initial installation for a variety of reasons, such as optimizing performance.

To understand how to configure LUM, you need to know the following:

- Secure LDAP Connections
- Trustee Assignments and Rights for LUM Objects
- How to Use NAMCONFIG



---

This topic introduces LUM configuration, but does not provide all the details you might need to complete configuration. For complete configuration information, see the “Novell Linux User Management Administration Guide.”

---

LUM passwords are not to be confused with the Universal Password feature in NetWare 6.5.

### Secure LDAP Connections

If you configure LUM to use SSL, the NNLS server uses a secure LDAP connection to eDirectory.

This ensures that information exchanged between the NNLS server and eDirectory is securely encrypted.

### Trustee Assignments and Rights for LUM Objects

A Linux Config object is created during NNLS product installation and configuration. The [Public] trustee is assigned [Read] rights to the Linux Config contexts attribute.

A Linux Workstation object is created during product configuration and installation. The [Public] trustee is assigned [Read] rights to the Group Membership attribute and [Compare] rights to the CN attribute.

When an eDirectory user is being assigned a Linux profile, the following trustees are assigned:

- [Read] rights for all Linux-related attributes to the [Public] trustee
- [Read] rights for the Group Membership attribute to the [Public] trustee
- [Compare] right for the CN attribute to the [Public] trustee

These trustee assignments occur only when a Linux profile is being assigned to a user. When the Linux profile is deleted, these trustee assignments are not reverted, because these assignments could have been modified by the administrator.

When an eDirectory group is assigned a Linux profile, the following trustees are assigned:

- [Read] rights for the Members attribute to the [Public] trustee
- [Read] rights for all Linux-related attributes to the [Public] trustee

## How to Use NAMCONFIG

The `namconfig` utility lets you add or remove LUM from a specified eDirectory context, as well as retrieve or set LUM configuration parameters.

Entering **`man namconfig`** at a command prompt displays the entire `namconfig` documentation. The following describes basic tasks you can perform with the `namconfig` utility:

- **Configuring a workstation with LUM.** To configure a specified workstation with LUM, use the following syntax:

```
namconfig add -a adminFDN -r partition_root -w  
workstation_context [-o] -S servername [:port] [-l  
sslport] [-R server [:port],server [:port],...]
```



For example:

```
namconfig add -a cn=admin,o=novell -r ou=nam,o=novell
-w ou=ws,ou=nam,o=novell -S MYSERVER:389
```

- **Configuring LUM with LDAP SSL.** You can configure LUM to use secure LDAP to ensure that the information exchanged between the NNLS server and eDirectory is securely encrypted.

To configure LUM with SSL, use the following command:

```
namconfig add -a cn=admin,o=novell -r ou=lum,o=novell
-w ou=ws,ou=nam,o=novell -S MYSERVER:389 -1 636
```

where the italicized names match your eDirectory admin object and containers.

- **Remove LUM.** To remove LUM from a specific eDirectory context, use the following syntax:

```
namconfig rm -a adminFDN
```

For example:

```
namconfig rm -a admin.novell
```

- **Setting or getting LUM configuration parameters.** The `namconfig` utility lets you set values for specific LUM configuration parameters or retrieve these values on the command line.

To do so, use the following syntax:

```
namconfig {set valuelist | get paramlist | help
paramlist}
```

For example:

```
namconfig set servername=namserver
```

- **Importing the SSL certificate.** To specify that the SSL certificate is to be imported into the local machine, use the following syntax:

```
namconfig -k
```



---

For a complete list of the command line parameters you can use to perform these namconfig tasks, see the “Novell Linux User Management Administration Guide.”

---

### ***How to Perform Basic LUM Tasks***

To manage user accounts with LUM, you need to know how to do the following:

- Create a LUM Group
- Create LUM Users
- Assign Passwords to LUM Users
- Create Home Directories for LUM Users
- Edit a Linux Config Object

#### **Create a LUM Group**

LUM users must belong to a LUM group, a group whose schema has been extended to include LUM properties, and the group must exist before the user is created.

You can create a LUM group by doing one of the following:

- Create a LUM Group Using `namgroupadd`
- Convert an eDirectory Group to a LUM Group
- Designate a Group as a LUM Group During Group Object Creation

#### **Create a LUM Group Using `namgroupadd`**

To create a LUM group, complete the following steps.

1. Open a terminal session and log in as root by entering **su -** at the shell prompt and entering the root password.
2. At the shell prompt, create 1 or more LUM groups for users to be associated with using the **namgroupadd** command.

For help with the command, use the **-h** option.

Be sure to use comma-delimited syntax when specifying an object's fully distinguished name.

For example, you might enter the following:

```
namgroupadd -a cn=admin,o=organization -w  
adminpassword -x ou=organizational unit,o=organization  
-A lumgroupname
```

where *admin*, *organization*, and other italicized parameters correspond to the Admin name, organization name, and other eDirectory names on your network.

3. At the shell prompt, exit the superuser session by entering **exit**.
4. Use iManager to browse the directory and confirm that your group object was created.

### Convert an eDirectory Group to a LUM Group

To convert an existing eDirectory group to a LUM group, do the following:

1. From iManager under **Linux User Management**, select **Convert eDir group to LUM group**.
2. At the right select the Object Selector icon (magnifying glass); then browse to and select the group you want to convert.
3. Continue by selecting **OK**.

A page appears requesting the workstations to add to the group. These are the workstations on which you want the users in the group to log in to Linux using the eDirectory user object information.

4. Do one of the following:
  - ❑ Select **Linux Config**; then browse to and select the **Linux Config** object that contains a context for workstations you want to include.
  - or*
  - ❑ Select **Linux Workstations**; then browse to and select the **Linux Workstation** objects that you want to include.
5. When you finish, select **OK**.

A “Complete: Success” message indicates that the eDirectory group object can now be used as a LUM group.

#### **Designate a Group as a LUM Group During Group Object Creation**

To designate a group as a LUM group during creation, do the following:

1. From iManager under **eDirectory Administration**, select **Create Object**.
2. At the right select **Group**; then select **OK**.
3. Assign the group object a **name** and **context**.

A “Complete: Create Group request succeeded” message appears.
4. Continue by selecting **OK**.

A page appears asking you if you want to make this group a LUM group.
5. Make it a LUM group by selecting **OK**.

A page appears requesting the workstations to be added to the group. These are the workstations on which you want the users in the group to log in to Linux using the eDirectory user object information.

6. Do 1 of the following:

- ❑ Select **Linux Config**; then browse to and select the **Linux Config** object that contains a context for workstations you want to include.

*or*

- ❑ Select **Linux Workstations**; then browse to and select the **Linux Workstation** objects that you want to include.

7. When you finish, select **OK**.

A “Complete: Success” message indicates that the LUM group was successfully created.



---

None of the above LUM group creation methods creates a Linux group. The result of each of these methods is an eDirectory group object that has LUM attributes added to it.

---

### Create LUM Users

After creating the LUM group, you need to create LUM users for the group.

You can create LUM users by doing one of the following:

- Create a LUM User Using `namuseradd`
- Create Multiple LUM Users with `make_nam_user.sh`
- Convert an eDirectory User to a LUM User
- Designate a User as a LUM User During User Object Creation

### Create a LUM User Using `namuseradd`

You have two options for creating LUM users to add to the group from a Linux shell prompt:

- **`namuseradd`**. This utility lets you create a single LUM user and specify various account attributes, such as the login password.
- **`make_nam_user.sh`**. This script automates much of the LUM-user-creation process by interacting with the `nameuseradd` utility to create multiple users as specified in a text file.

However, if you create LUM users with this script, you must manually specify a login password using iManager for each user created.

To create a Linux user for a LUM group using `nameuseradd`, do the following:

1. Open a terminal session and log in as root by entering **`su -`** and entering the root password.
2. At the shell prompt, create 1 or more LUM users with the **`namuseradd`** command.

For help with the command, use the **`-h`** option.

Be sure to use comma-delimited syntax when specifying an object's fully distinguished name.

For example, you might enter the following:

```
namuseradd -a cn=admin,o=organization -g
cn=lumgroupname,o=organization -x
ou=users,o=organization username
```

where *admin*, *organization*, and other italicized parameters correspond to the Admin name, organization name, and other eDirectory names on your network.

3. If you want to create additional users, repeat this process.
4. When you finish, exit the root session by entering **`exit`**.

### Create Multiple LUM Users with `make_nam_user.sh`

You can create multiple LUM users at once using the `make_nam_user.sh` script file.

However, users created with this script must have passwords created for them using iManager.

To create multiple users for a LUM group with a script, do the following:

1. Log in to your NNLS server as root.
2. In a directory of your choosing, start a text editor, create a file named **user\_list**, and include a username on each line.

For example, if you want users named smithers, jones, bumstead, and einstein to access the NNLS server using LUM, create a file with the following content:

```
smithers
jones
bumstead
einstein
```

These names will actually be used for the Last Name attribute in eDirectory. The attribute corresponds to the userid on the Linux system.

3. While in the directory where you created the **user\_list** text file, run the **make\_nam\_user.sh** script, specifying a LUM group and the comma-delimited context where users should be created.

For example, you might enter the following:

```
make_nam_user.sh -g cn=lumgroupname,o=organization -x
ou=users,o=organization
```

where the italicized parameters correspond to eDirectory names.

4. When prompted, enter the Admin's fully distinguished name in comma-delimited format; then enter the password.

The `make_nam_user.sh` script runs the `namuseradd` utility with the appropriate parameters to add each user individually to the group.

### Convert an eDirectory User to a LUM User

To convert an existing eDirectory user to a LUM user, do the following:

1. Find out which users are assigned to the converted eDirectory group:
  - a. From iManager under **eDirectory Administration**, select **Modify Object**.
  - b. On the right, select the Object Selector icon (magnifying glass); then browse to and select the eDirectory group you converted to a LUM group.
  - c. Continue by selecting **OK**.
  - d. From the Modify Object drop-down list at the top of the page, select **General: Members**.
  - e. From the Members list, record the full DN (distinguished name) members in the group you want to convert to LUM users.
2. When you finish, scroll down to Linux User Management; then select **Convert eDir user to LUM user**.
3. On the right, select the Object Selector icon (magnifying glass); then browse to and select the eDirectory object for the first user in your group.
4. Continue by selecting **OK**.

You are prompted to select the primary group for your first user.
5. Browse to and select the eDirectory group object.
6. When you finish, continue by selecting **OK**.



A “Complete: Success” message indicates that the LUM user is successfully created for your first user.

7. Select **Repeat Task**; then repeat steps 3 through 6 for the second user.

#### **Designate a User as a LUM User During User Object Creation**

To designate a user as a LUM user during creation, do the following:

1. From iManager under **eDirectory Administration**, select **Create Object**.
2. At the right select **User**; then select **OK**.
3. Fill in the user object information as needed; then select **OK**.

A “Complete: The Create User request succeeded” message appears.

4. Continue by selecting **OK**.

A page appears asking you if you want to make this user a LUM user.

5. Make it a LUM user by selecting **OK**.

The Select Primary Group for User page appears.

6. Enter the name of the **primary group** you want this user to be associated with; then select **OK**.

A “Complete: Success” message indicates that the LUM user was successfully created.



---

This is followed by a Make Samba user page. This course will address Samba in a later section.

---

## Assign Passwords to LUM Users

The `make_name_user.sh` script creates eDirectory users, but it doesn't assign them passwords.

However, passwords are required to log in to the NNLS server.

To assign eDirectory passwords to LUM users, do the following:

1. In a browser, access iManager on the NNLS server by entering the following:

**`https://IP_or_DNS/nps/iManager`**

where *IP\_or\_DNS* is the IP address or DNS name of your NNLS server.

2. Enter the eDirectory Admin name and password you created on the NNLS server during installation.
3. At the left under **Users**, select **Modify User**.
4. At the right select the Object Selector icon (magnifying glass); then browse to and select the eDirectory user object for the user you want to assign a password.
5. Continue by selecting **OK**.
6. From the Modify User drop-down list, select **NMAS Login Methods: eDirectory Password**.
7. Select **Set Password**; then enter the *password* in the Set eDirectory password and the Confirm eDirectory password fields.
8. When you finish, select **OK**.

Repeat this process from Step 3 for each LUM user.

## Create Home Directories for LUM Users

Initially, LUM users do not have the file system rights (home directories, etc.) normally assigned to Linux users when they are created.

To complete the setup for your LUM users, do the following:

1. In a text-based Linux console, log in using a LUM username and password pair.

This step must be completed in a text-based console. It does not work through an SSH connection or a terminal window within a GUI console such as KDE or Gnome.

You can access a text-based console from a GUI console by pressing **Ctrl+Alt+F1**.

2. Make sure that the screen indicates creation of the home directory and system files.
3. Repeat this process for each LUM user.



---

The home directory, created in this process, is not an eDirectory user attribute and will not be shown in the user object's properties.

---

## Edit a Linux Config Object

Do the following:

1. From iManager, at the left under **Linux User Management**, select **Linux Config**.
2. Browse to and select the **Linux Config** object; then select **OK**.
3. Make any changes necessary; then select **OK**.

**25 minutes**

### ***Exercise 4-4 Implement LUM in Your Container***

In this exercise, you do the following:

- Part I: Create a LUM Group for Database User Employees
- Part II: Add Database User Employees to the LUM Group
- Part III: Test LUM Access
- Part IV: Troubleshoot LUM Access

#### **Part I: Create a LUM Group for Database User Employees**

To create a LUM group for employees that use the expense report database utility, do the following:

1. Log in to iManager as **admin** with a **novell** password.
2. Under **Linux User Management**, select **Convert eDirectory group to LUM group**.
3. At the right, select the Object Selector icon (magnifying glass); then browse to and select the **DBUSERS** group in ***your container***.
4. Continue by selecting **OK**.
5. Select **Linux Workstations**; then browse to and select the **UNIX Workstation - DAx** object in your container.
6. When you finish, continue by selecting **OK**.

A “Complete: Success” message appears, indicating that the LUM group has been successfully created.

#### **Part II: Add Database User Employees to the LUM Group**

Now that you have created a LUM group for DBUSERS, you need to create a LUM user for each eDirectory user in the group.

Do the following:

1. Find out which users are assigned to your DBUSERS group:
  - a. From iManager under **eDirectory Administration**, select **Modify Object**.
  - b. At the right, select the Object Selector icon (magnifying glass); then browse to and select the **DBUSERS** group in *your container*.
  - c. Continue by selecting **OK**.
  - d. From the Modify Object drop-down list at the top of the page, select **General: Members**.
  - e. From the Members list, record the full DN (distinguished name) of 4 of the users, excluding admin, in your group:

☐  
☐  
☐  
☐
2. Attempt to log in as 1 of these users:
  - a. Display a command-line console by pressing **Ctrl+Alt+F2**.
  - b. Enter the login name (username) for the *first user* in your list; then enter **novell** for the password.

You should get a “Login incorrect” message because this user has not been converted to a LUM user yet.
  - c. Return to your desktop by pressing **Alt-F7**.
3. In iManager at the left, scroll down to **Linux User Management**; then select **Convert eDirectory user to LUM user**.
4. At the right, select the Object Selector icon (magnifying glass); then browse to and select the eDirectory object for the *first user* in your list.
5. Continue by selecting **OK**.

Remind students not to convert the fourth user in their list at this time.

You are prompted to select the primary group for your first user.

6. Browse to and select **DBUSERS** in *your container*.
7. Deselect **Also convert this user to a Samba user**.
8. When you finish, continue by selecting **OK**.

A “Complete: Success” message indicates that the LUM user is successfully created for your first user.

9. Select **Repeat Task**; then repeat steps 4 through 8 for the *second* and *third* users in your list. *Do not* repeat this task for the fourth user in your list.

### Part III: Test LUM Access

In this part of the exercise, you test LUM access by logging in as the eDirectory users that you have converted to LUM users.



---

The login process also creates Linux home directories for these users. These home directories will be used in the Samba exercise in Section 6.

---

Do the following:

1. Start a Trace screen in iMonitor:
  - a. From the Mozilla menu, select **File > New > Navigator Window**.
  - b. In Mozilla, enter **https://DAX.your container.digitalairlines.com:8010**.
  - c. Select **DS TRACE**.
  - d. Log in as **admin** with **novell** as the password.
  - e. Select **DS Trace**.
  - f. Select **Clear All**.
  - g. Select the **Authentication** check box; then select **Trace On**.
  - h. Select the **Trace History** link on the left.

- i. Select the **Trace** icon at the top of the iMonitor window.

This opens the Trace Live window, which is probably empty right now.

2. Display a command-line console by pressing **Ctrl+Alt+F2**.
3. Enter the login name (username) for the **first user** in your group; then enter **novell** for the password.

A message indicates that Linux is creating a home directory (such as /home/KSingh) for the user. Linux also creates other subfolders (such as /home/KSingh/Documents) for the user.



---

If you receive a “Login incorrect” message at this point, refer to Part IV of this exercise for troubleshooting steps.

---

4. Enter **logout**.
  5. Enter the login name (username) for the **second user** in your group; then enter **novell** for the password.
- A message indicates that Linux is creating a home directory for the user.
6. Enter **logout**.
  7. Enter the login name (username) for the **third user** in your group; then enter **novell** for the password.

A message indicates that Linux is creating a home directory for the user.

8. Enter **logout**.
9. Return to the desktop by pressing **Alt-F7**.
10. From iMonitor at the left, select **Update**.

Scroll down in the Trace Live window to see that your LUM users were authenticated through eDirectory.

11. (Conditional) If you do not see any new authentication data added to the Trace Live window, go to the **Trace Configuration** window and select **Update**.
12. Return to the command-line console by pressing **Ctrl-Alt-F2**.
13. Enter the login name (username) for the *fourth user* in your group; then enter **novell** for the password.



---

This is the user that you did not convert to a LUM user.

---

You should see a “Login incorrect” message.

14. Return to the desktop by pressing **Alt-F7**.
15. From iMonitor at the left, select **Update**.

Scroll down in the Trace Live window to see that this non-LUM user’s login attempt does not get noticed by eDirectory.
16. (Optional) Convert the fourth user in your list to a LUM user; then test this user’s LUM access as you did for the previous 3 users. Validate this user’s eDirectory authentication by updating the Trace Live screen.
17. When you finish, close the browser windows.

#### Part IV: Troubleshoot LUM Access

(Optional) If you get a “Login incorrect” message when attempting to log in as a LUM user, do the following:

1. Enter the following 2 commands at the shell prompt:

```
namuserlist -x o=your context  
id username
```



For example, if your context is LGA and your user's name is KFullmer, you would enter

```
namuserlist -x o=lga  
id KFullmer
```

If your user's name fails to show up with either of these 2 commands, then you need to refresh the name cache daemon (named). Go to step 2.

If your user name *does* appear with these 2 commands, and if you still cannot log in as a LUM user at the shell prompt, then refreshing the name cache might still solve the problem. Go to step 2.

2. Refresh the named by entering the following:

```
/etc/init.d/named stop  
/etc/init.d/named start
```

This process should place your user's name in name cache and allow you to proceed to login as a LUM user.

3. Re-enter the commands from Step 1 to see that your LUM user's name does show up in the list.

If the user's name still does not show up, double-check that this user was actually converted to a LUM user.

4. Return to Part III, Step 3.

***(End of Exercise)***

## Summary

Objective	Summary
1. <b>Manage User Objects with iManager</b>	<p>To manage user objects on your Linux server with iManager, you need to know the following:</p> <ul style="list-style-type: none"><li>■ How to Create User Objects</li><li>■ How to Modify User Objects</li><li>■ How to Move Objects</li><li>■ How to Delete User Objects</li><li>■ How to Extend the eDirectory Schema with an Auxiliary Class</li></ul>
2. <b>View User Information with eGuide</b>	<p>eGuide is a web application that lets you search for and view information about people, places, and things stored in eDirectory and other LDAP data sources at the same time.</p> <p>eGuide looks like an address book and can be accessed by any user with rights to your Web server via a standard Web browser.</p> <p>To view user information with eGuide, you need to know the following:</p> <ul style="list-style-type: none"><li>■ The Features of eGuide</li><li>■ How to Access the eGuide Client</li><li>■ How to Configure eGuide for LDAP</li></ul>

Objective	Summary
<b>3. Access a Linux Server with Linux User Management (LUM)</b>	<p>Linux User Management (LUM) is a Novell eDirectory-based service for Linux systems that allows Linux users to leverage eDirectory as a user account management solution.</p> <p>To use LUM for managing user accounts, you need to know the following:</p> <ul style="list-style-type: none"><li>■ What LUM Is</li><li>■ LUM Components</li><li>■ eDirectory LUM Objects</li><li>■ User Accounts</li><li>■ Group Accounts</li><li>■ How to Configure LUM</li><li>■ How to Perform Basic LUM Tasks</li></ul>

---



## SECTION 5      Synchronize User Identities with NNLS

In this section, you learn how to use DirXML® to synchronize user objects from text files and between 2 eDirectory™ trees.

### Objectives

1. Describe the Purpose of DirXML
2. Describe How DirXML Works
3. Install the DirXML Starter Pack on Linux
4. Implement the Delimited Text Driver for DirXML
5. Implement the eDirectory Driver for DirXML

### Introduction

Today's businesses are faced with the challenge of managing user accounts in many independent systems. The creation and management of separate user accounts is expensive and prone to data synchronization errors.

DirXML is a data-sharing solution that leverages Novell® eDirectory™ to automatically synchronize, transform, and distribute information across applications, databases, and directories.

The DirXML Starter Pack solution included with Novell® Nterprise™ Linux® Services (NNLS) provides licensed synchronization of information stored in NT® Domains, Active Directory™, and eDirectory.

Evaluation drivers are also included for several other systems, including PeopleSoft®, Exchange, and Lotus Notes®. These drivers let you explore data synchronization for other applications and systems.

The DirXML Starter Pack also lets you synchronize user passwords with PasswordSync. With this feature enabled, users only need to remember a single password to log in to any DirXML-enabled application or system.

## **Objective 1      Describe the Purpose of DirXML**

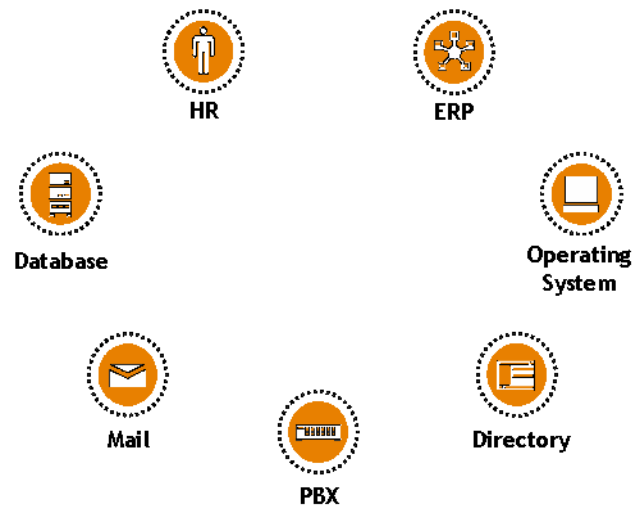
To describe the purpose of DirXML, you need to know the following:

- What DirXML Is
- How DirXML Helps Enterprises Solve Data Synchronization Tasks

### ***What DirXML Is***

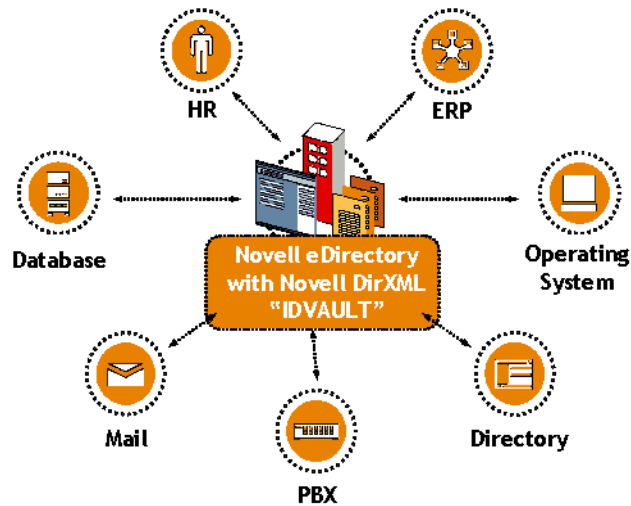
Most companies store data in a variety of directories and databases that are associated with various applications and services and isolated from each other, as shown in the following:

**Figure 5-1**



Novell DirXML is a data-sharing service that runs on Novell eDirectory. With DirXML, eDirectory acts as a hub for synchronizing and sharing selected data across the network, as shown in the following:

**Figure 5-2**



When data from one system changes, DirXML detects and synchronizes these changes to other connected applications based on business rules you define to match and enforce business process requirements.

Using DirXML rules and style sheets, you can make any of these systems the authoritative source for all or some of the data, or you can make each of the systems equally responsible for updating any data changes.

DirXML provides the following features and benefits:

- Runs on the following Novell eDirectory supported platforms: NetWare®, Win2K, NT®, Solaris®, and Linux®
- Allows administrator to determine the data to be shared



- Manages the data relationships between the connected applications
- Requires no changes to existing applications
- Transforms data into the format required by the target application
- Allows DirXML drivers running on one platform to communicate with the DirXML engine running on a different platform through the Remote Loader Service



---

On a Linux server, the rdxml component is located in the /usr/bin/ directory.

For information on installing, configuring, and running the Remote Loader on Linux, see “Using the Remote Loader Service” in the Novell DirXML administration guide at <http://www.novell.com/documentation/a-z.html>.

---

### ***How DirXML Helps Enterprises Solve Data Synchronization Tasks***

DirXML helps enterprises solve data synchronization tasks by doing the following:

- **Captures changes.** DirXML uses eDirectory events (such as add, delete, or modify) to capture changes in the eDirectory data store.
- **Provides a data hub.** DirXML centralizes or distributes data management by acting as a hub to pull all the data together.
- **Provides XML support.** DirXML exposes directory data in XML format, allowing it to be used and shared by XML applications or applications integrated through Nsure Resources™.
- **Controls data flow.** DirXML controls the flow of data using specific filters that govern data elements defined in the system.

- **Enforces authoritative data sources.** DirXML enforces authoritative data sources by using permissions and filters.
- **Applies rules to directory data.** These rules govern the interpretation and transformation of the data as changes flow through Nsure Resources.

The following are examples of enterprise activities for which DirXML can provide a solution:

**Table 5-1**

<b>Activity</b>	<b>DirXML Solution</b>
Manage User Accounts	<p>With a single operation:</p> <ul style="list-style-type: none"> <li>■ DirXML grants or removes employee access to resources almost immediately.</li> <li>■ DirXML provides automated employee provisioning capability, giving a new employee access to network, email, applications, resources, and so forth.</li> <li>■ DirXML can also restrict or disable access when an employee is terminated or goes on leave.</li> </ul>
Track and Integrate Asset Inventory	DirXML can add profiles for all asset inventory items (computers, monitors, phones, library resources, chairs, desks, etc.) to eDirectory and integrate them with user profiles such as individuals, departments, or organizations.
Automate White/Yellow Page Directories	DirXML can create unified directories with varying levels of information for internal and external use. External directories might contain only email addresses; internal directories might include phone, fax, and cell numbers, home address, location, etc.

**Table 5-1** *(continued)*

<b>Activity</b>	<b>DirXML Solution</b>
Enhance User Profiles	DirXML augments user profiles by adding or synchronizing information such as email address, phone number, home address, preferences, reporting relationships, hardware assets, phone number, keys, inventory, and more.
Unify Communications Access	DirXML simplifies network, phone, pagers, Web, wireless access, etc., for individual users or groups by synchronizing directories for each in a common management interface.
Strengthen Partner Relationships	DirXML strengthens partnerships by creating profiles (employee, customer, etc.) in partner systems outside the firewall to enable partners to provide immediate service as needed.
Improve Supply Chain	DirXML improves customer services by recognizing and consolidating instances of multiple accounts per customer.
Build Customer Loyalty	DirXML offers new services in response to customer needs identified as a result of viewing data together that was previously isolated in silos.
Customize Service	<p>DirXML provides users (employees, customers, partners, etc.) with profiles containing synchronized information, including relationships, status, and service records.</p> <p>These profiles can be used to provide varying levels of access to services and information, and offer real-time, customized services based on a customer's standing.</p>

## **Objective 2      Describe How DirXML Works**

DirXML's main purpose is to provide for the clean movement of data between eDirectory and any application, directory, or database.

To accomplish this, the DirXML interface translates directory data and events into XML format. This interface allows the data to flow in and out of eDirectory in a bidirectional manner.

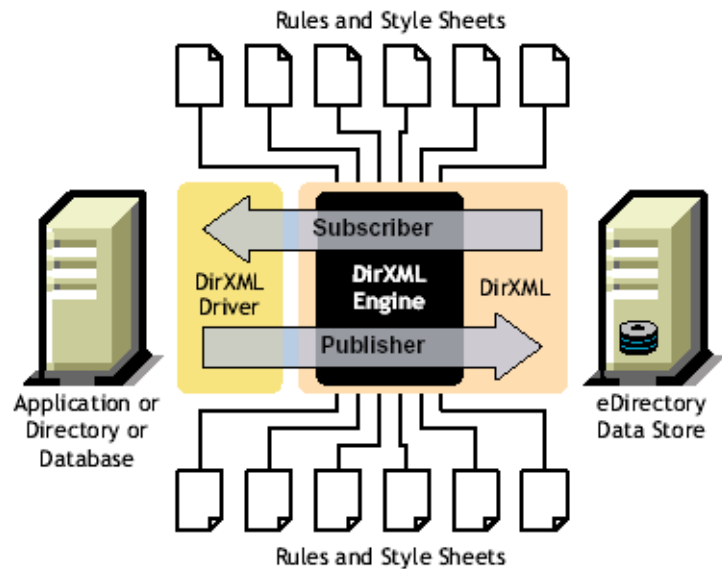
To describe how DirXML works, you need to understand the following:

- DirXML Architecture
- DirXML Data Processing Components
- Associations
- DirXML Objects in eDirectory

### DirXML Architecture

The following shows the basic DirXML architecture and components and their relationships:

Figure 5-3



To describe the DirXML architecture, you need to understand the following:

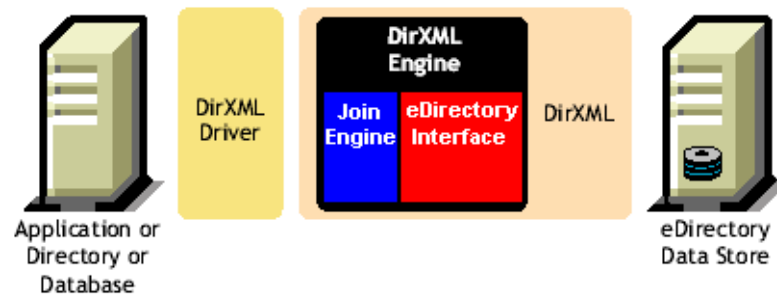
- DirXML Engine
- DirXML Driver
- Publisher and Subscriber Channels

### DirXML Engine

The DirXML engine is the key component in the DirXML architecture that allows a DirXML driver to synchronize information with eDirectory.

The DirXML engine contains 2 basic components:

Figure 5-4



- **eDirectory interface.** The eDirectory interface which is built into the DirXML engine is used to detect events that take place in eDirectory. This interface guarantees the delivery of events to DirXML by using the event cache.

All of the events generated through eDirectory are stored in the event cache until they are successfully processed.

This guarantees that no data will be lost because of a bad connection, loss of system resources, unavailability of a driver, or any other network failure.

The eDirectory interface supports multiple driver loading, which means that even though only one instance of DirXML is running, eDirectory can communicate with multiple applications.

Loopback detection is built into this interface to prevent event loops from occurring between eDirectory and the application.

- **Join engine.** The Join engine applies the DirXML XML-based rules (XDS) to each event presented to it.

DirXML rules can also be in the form of Extensible Stylesheet Language Transformation (XSLT), which is a more powerful XML vocabulary defined for operating on, and then transforming, XML documents.

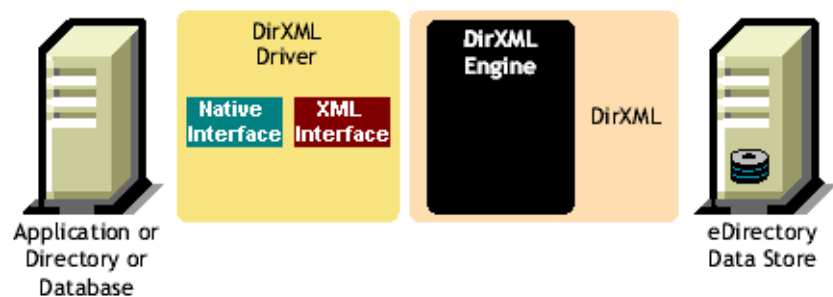
The ability to complete these transformations is one of the most powerful capabilities of DirXML. Data is transformed in real time as it is shared between eDirectory and individual applications.

### DirXML Driver

The DirXML driver is the path through which information is transferred between eDirectory and the application, directory, or database.

The DirXML driver contains 2 basic components:

Figure 5-5



- **XML interface.** The XML interface issues and receives XML documents, and converts XDS events to application events and vice versa (for example, “delete” in eDirectory might be “remove” in ANF).
- **Application native interface.** The native interface notifies eDirectory of application-generated events. It is similar to the eDirectory interface, but can use the application’s own remote capability (if any).

Communication between the DirXML engine and the driver is handled through XML documents that describe events, queries, and results.

When an event occurs in eDirectory that causes an action in the synchronized application or directory, DirXML creates an XML document that describes the eDirectory event and submits it through the Subscriber channel to the driver.

When an event occurs in the synchronized application, directory, or database, the driver generates an XML document that describes the application event. The driver then submits the XML document to DirXML through the Publisher channel.

After processing the event through any rules or transformation style sheets, DirXML tells eDirectory to take the appropriate action.

Each driver supports the following events:

- Add (creation)
- Modify
- Delete
- Rename
- Move
- Modify-Password

In addition, the driver must support a defined query capability so that DirXML can query the synchronized application, directory, or database.

Driver configurations, also referred to as preconfigured driver files, are XML files that are included with DirXML. You can import these configuration files through the wizards in iManager.

These driver configurations contain sample rules and style sheets. They are not intended for use in a production environment, but rather as a template for you to modify.



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A DirXML driver is written in either Java® or C++.

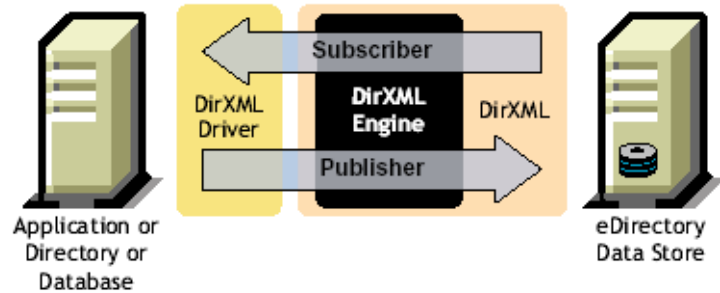
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### Publisher and Subscriber Channels

A DirXML driver contains a Publisher channel and a Subscriber channel for processing data:

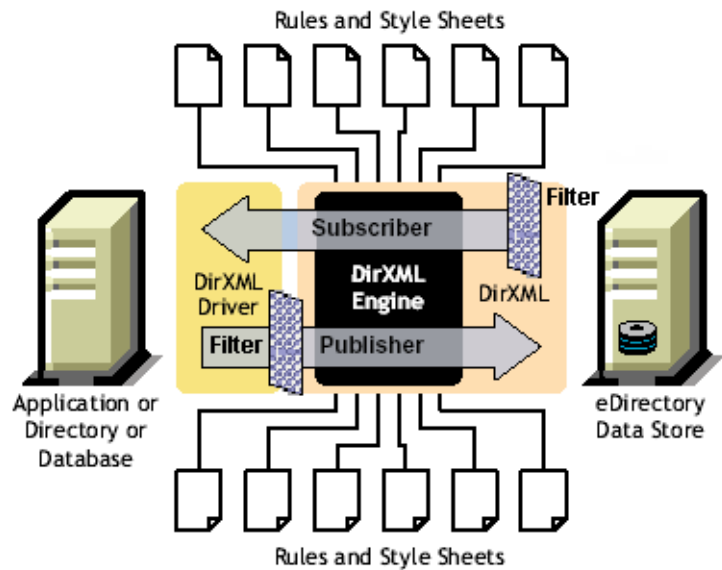
Figure 5-6



- The Publisher channel propagates events from the application to eDirectory.
- The Subscriber channel propagates events from eDirectory to the application.

Each channel contains its own rules and style sheets that define how to process and transform data.

**Figure 5-7**



Both channels also include a filter that defines the object classes and associated attributes you want to synchronize.

Remember that the channels are used to propagate events.

For example, when a user is created in eDirectory, an event flows down the subscriber channel. Any communication regarding that event is communicated on the subscriber channel, even responses that come from the remote database.

Remember to always look at the publisher and subscriber channels from the point of view of the application.

The application publishes to eDirectory through the publisher channel, and subscribes to eDirectory events through the subscriber channel.

### ***DirXML Data Processing Components***

The DirXML architecture uses the following basic components to process data for synchronization:

- DirXML Filters
- Matching Rules
- Creation Rules
- Placement Rules
- Schema Mapping Rules
- Transformation Style Sheets

Filters control which changes to data in eDirectory and an associated application are processed.

Rules help DirXML transform an event on a channel input into a set of commands on the channel output. You can configure the way each driver synchronizes data and events by configuring the rules.

For example, if a Creation rule specifies that a User object must have a value for the Given Name attribute, any attempt to create a User object without a given name value will be rejected.

### **DirXML Filters**

Filters let you control the way data flows from one system to another, establishing data ownership (authoritative data source).

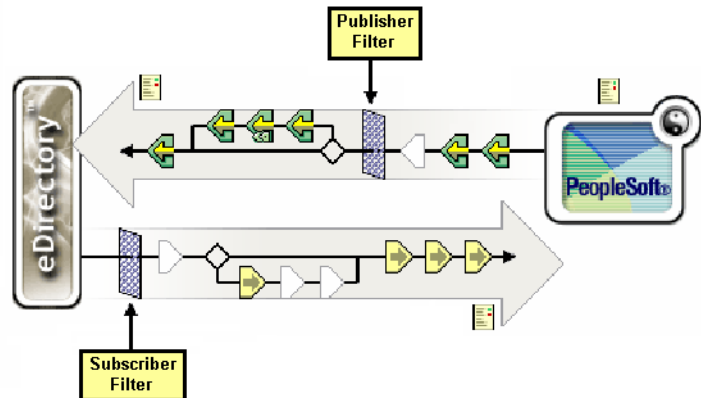
Publisher filters contain the set of classes and attributes whose updates can be published to eDirectory from the application.

Subscriber filters contain the set of classes and attributes whose updates the application receives from eDirectory.

Filters also help reduce the amount of processing required of the XSL processor because unwanted events are eliminated before translation and processing.

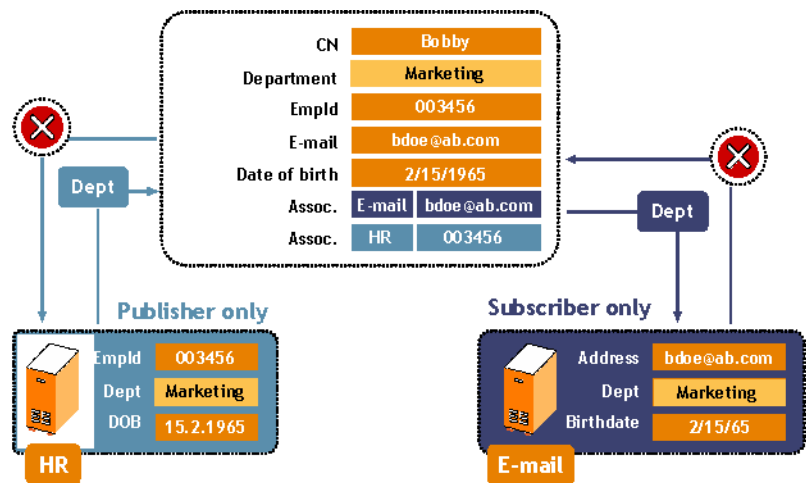
The following DirXML Driver Overview in iManager shows the location of the filters in the Publisher and Subscriber channels:

**Figure 5-8**



The following is an example of establishing an authoritative data source for data ownership with filters:

Figure 5-9



Notice that HR can publish (add and edit) the Department value (Marketing) for Bobby Doe to Bobby's record in eDirectory. Including the Dept attribute in HR's publisher filter allows this to happen, and makes HR the authoritative source for the Department value.

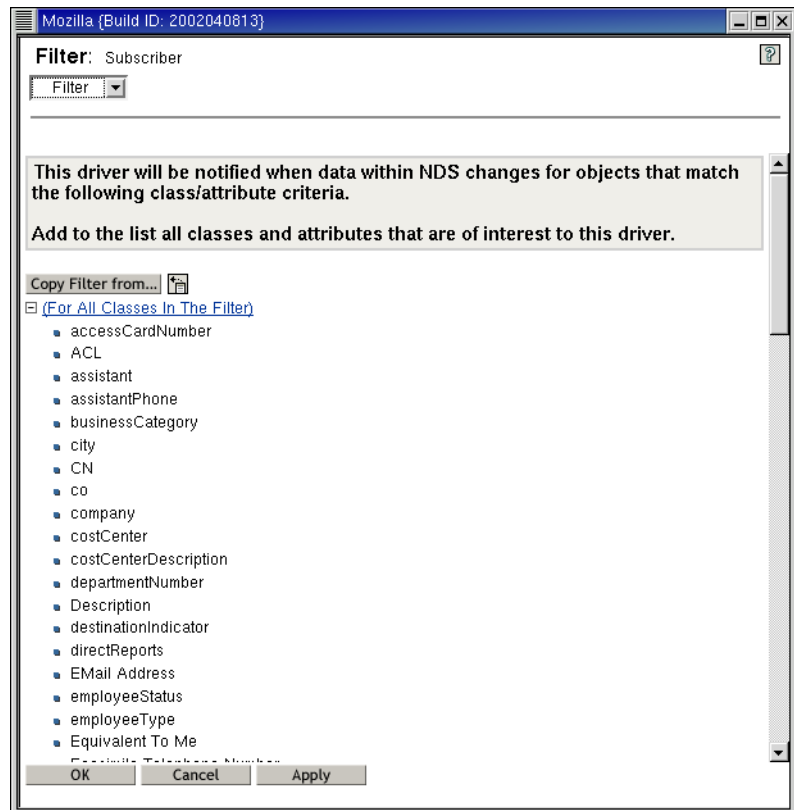
However, HR cannot receive updates from eDirectory to the Department value because HR's subscriber filter has the Dept attribute removed.

On the other hand, the email administrator can only subscribe (receive) updates to the Department value from Bobby's record in eDirectory, making the email application subordinate.

This creating of an authoritative data source is done by adding the Dept attribute to the email application's subscriber filter, but removing it from the email application's publisher filter.

The following illustrates selected classes and attributes (displayed in iManager) for an Active Directory subscriber filter:

**Figure 5-10**



### Matching Rules

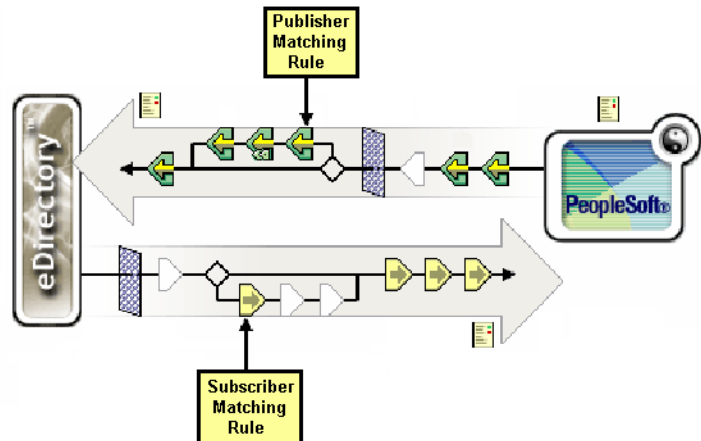
The Matching rule is applied to an Add Object event and does the following:

- Establishes links (associations) between an existing entry in eDirectory and an existing entry in the external application

- Attempts to find an existing object that matches the object generating the event based on the criteria specified in the rule

You can view the order of the Matching rule process by displaying the DirXML Driver Overview in iManager:

**Figure 5-11**



For example, assume that the Subscriber channel Matching rule specifies that User objects are to be matched by Surname and Email Address.

When a User object is added to eDirectory, an Add Object event document is generated. The Matching rule is applied and DirXML queries the synchronized application or directory for any object in the class mapped to User with attribute values that match the eDirectory object's Surname and Email Address values.

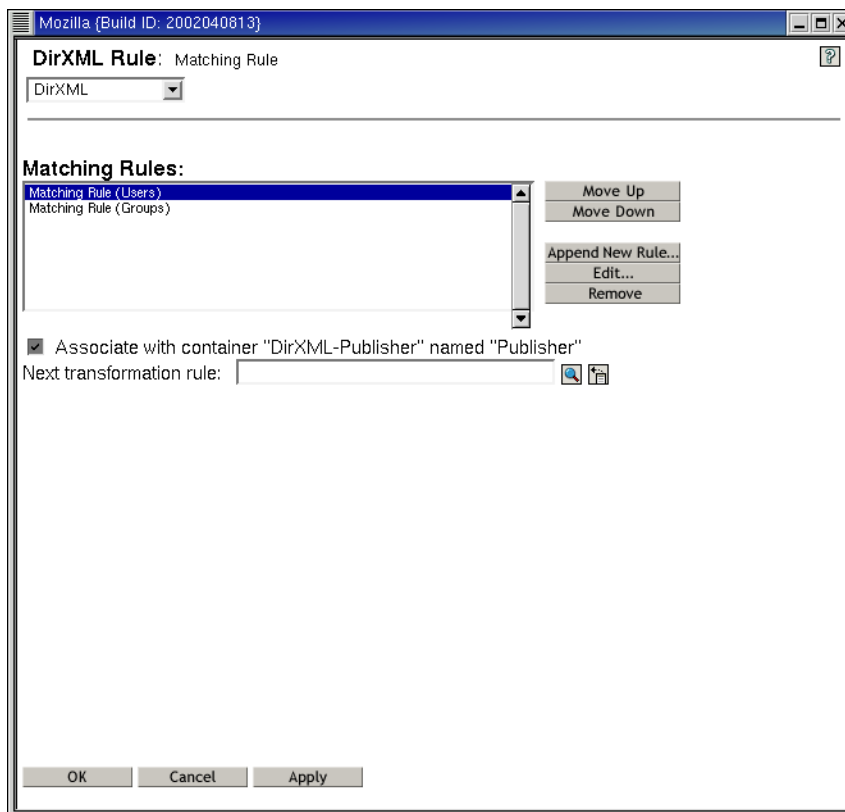
One of the following happens:

- If a single match is found, an association is formed between the eDirectory object and the matched object in the application or directory.
- If multiple matches are found, the event is discarded, because DirXML is unable to resolve which object it should match.

- If no match is found, a new object will be created in the application or directory.

Typically, a Matching rule is configured on both the Subscriber and the Publisher channels. You can configure the Matching rule using iManager:

**Figure 5-12**





You can also directly edit the XML document that describes the Matching rule:

**Figure 5-13**

```
<?xml version="1.0" encoding="UTF-8"?>
<matching-rules>
  <matching-rule description="Initial Matching Criteria">
    <match-class class-name="User"/>
    <match-attr attr-name="Surname"/>
    <match-attr attr-name="Social Security Number"/>
  </matching-rule>
  <matching-rule description="Secondary Matching
Criteria">
    <match-class class-name="User"/>
    <match-attr attr-name="Given Name"/>
    <match-attr attr-name="Surname"/>
    <match-attr attr-name="Telephone Number"/>
  </matching-rule>
</matching-rules>
```

## Creation Rules

A Creation rule

- Is applied to an Add object event document
- Controls whether an object will be added based on the existence of required attribute values
- Might assign default values to attributes whose values are not present in the event document

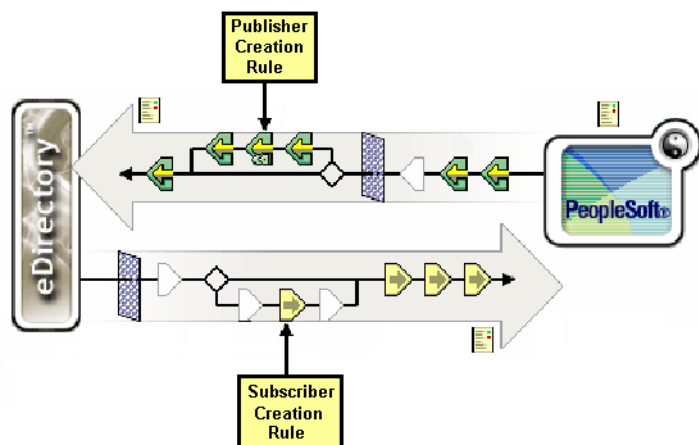
A Creation rule can be the same for both the Subscriber and the Publisher, or it can be different. In other words, one database might require more information than the other for the creation to succeed.

A Subscriber Creation rule defines the minimum set of attributes that must be present in eDirectory for an Add operation to add an object in the third-party system.

A Publisher Creation rule defines the minimum set of attributes that must be present in the third-party system in order to create a new eDirectory object.

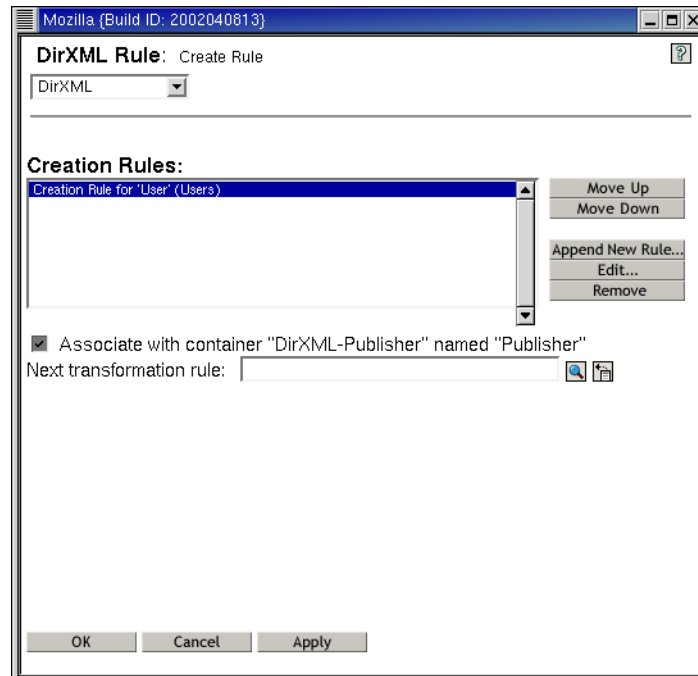
You can view the order of the Creation rule process by displaying the DirXML Driver Overview in iManager:

**Figure 5-14**



Typically a Creation rule is configured on both the Subscriber and Publisher channels. You can configure the Creation rule in iManager:

**Figure 5-15**



You can also directly edit the XML document that describes the Creation rule:

**Figure 5-16**

```
<?xml version="1.0" encoding="UTF-8"?>
<create-rules>
  <create-rule class-name="User" description="Create Rule">
    <required-attr attr-name="Given Name"/>
    <required-attr attr-name="Surname"/>
    <required-attr attr-name="uniqueID"/>
    <required-attr attr-name="L">
      <value type="string"><![CDATA[Provo]]></value>
    </required-attr>
    <template template-dn="DirXML-Tree\Novell\User-
Role"/>
  </create-rule>
</create-rules>
```

## Placement Rules

A Placement rule is applied to an Add Object event document and can do the following:

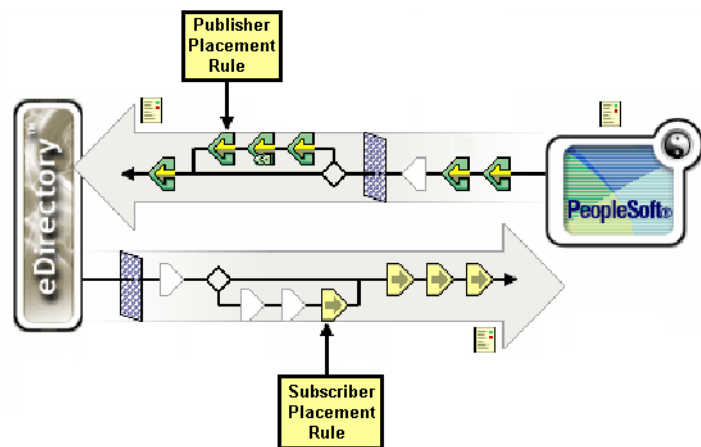
- Determine the placement of the new object in the hierarchical structure of eDirectory (Publisher channel) or the synchronized application or directory (Subscriber channel)
- Typically determine the placement of the new object based on the placement of the originating object
- Determine placement based on attribute values of the originating object

Typically a Placement rule is configured on both the Subscriber and Publisher channels. However, if the synchronized application has a flat naming space, the Placement rule might not be needed on the Subscriber channel.

Placement rules determine where new objects are created in eDirectory and the connected application. Some drivers do not necessarily require Placement rules.

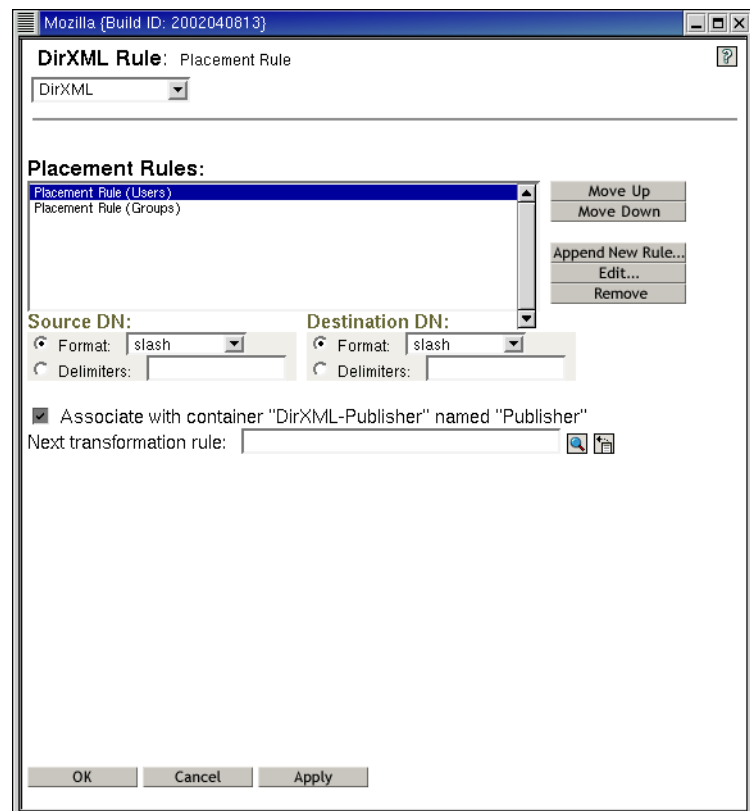
You can view the order of the Placement rule process by displaying the DirXML Driver Overview in iManager:

**Figure 5-17**



You can configure the Placement rule in iManager:

**Figure 5-18**



You can also directly edit the XML document that describes the Placement rule:

**Figure 5-19**

```
<?xml version="1.0" encoding="UTF-8"?>
<placement-rules dest-dn-format="slash" src-dn-format="ldap">
  <!-- Placement rule for User objects.-->
  <placement-rule description="Placement based on Location">
    <match-class class-name="User"/>
    <match-attr attr-name="L">
      <value type="string"><![CDATA[Provo]]></value>
    </match-attr>
    <placement>
      <![CDATA[\\DirXML-Tree\\Novell\\PRV]]><copy-name/>
    </placement>
  </placement-rule>
  <placement-rule>
    <match-class class-name="User"/>
    <placement>
      <![CDATA[\\DirXML-Tree\\Novell\\]]><copy-attr attr-name="Surname"/>
    </placement>
  </placement-rule>
</placement-rules>
```

If the external application database is not hierarchical, one Placement rule should be sufficient.

However, because eDirectory is hierarchical, multiple rules can be useful because they let you create objects in multiple containers. Multiple rules can be made within one Placement Rule eDirectory object.

### Schema Mapping Rules

Although Schema Mapping rules can be an important part of an Nsure solution, they are not covered in the course exercises.

For this reason, you might want to briefly introduce Schema Mapping rules, and then move on.

A key problem when synchronizing data across different applications is the fact that each application has its own schema, and data in that schema can be represented differently from the data in another schema.



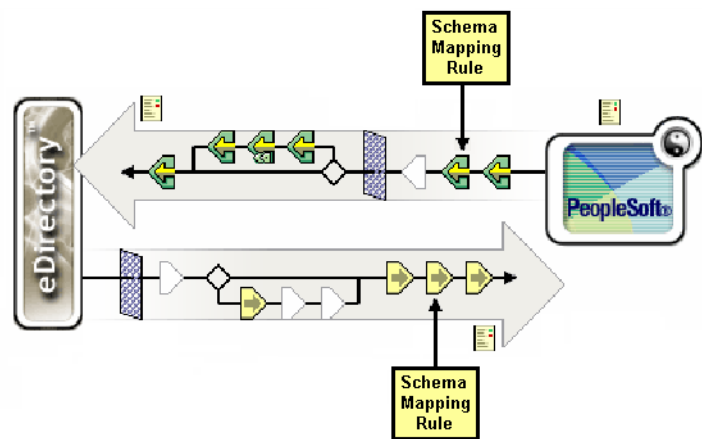
You can use the Schema Mapping rule to map the names of attributes and classes between eDirectory and the synchronized application or directory.

The Schema Mapping rule is applied to an XML document *going to* the DirXML driver as the next-to-the-last process of the document.

The Schema Mapping rule is applied to an XML document *coming from* the DirXML driver as the second step of processing the document.

You can view the order of the Schema Mapping rule processing by displaying the DirXML Driver Overview in iManager:

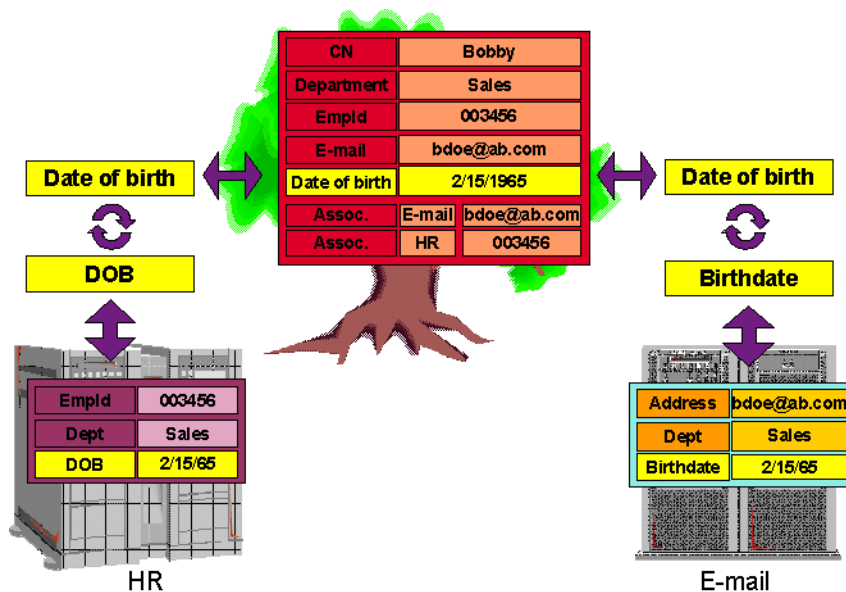
**Figure 5-20**



For example, an HR database might store a birthdate as a DOB attribute, while an email database might store a birthdate as a Birthdate attribute.

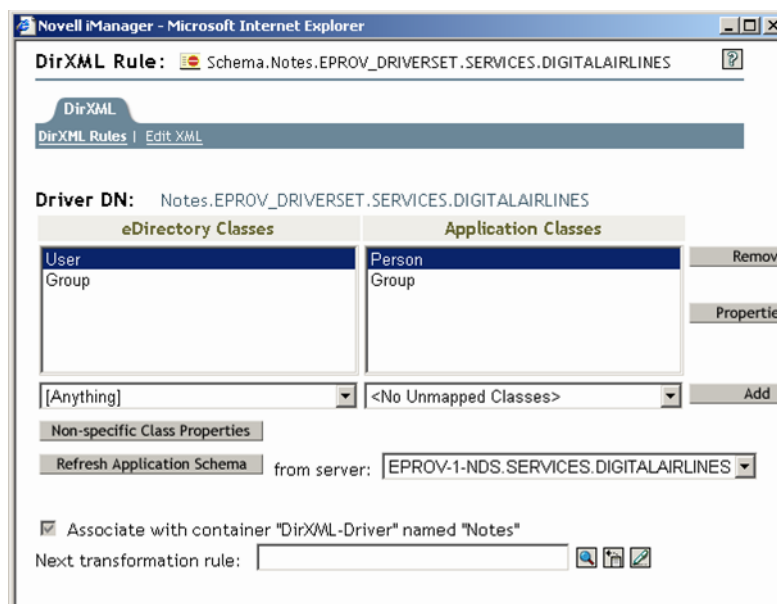
By using a Schema Mapping rule, you can map DOB and Birthdate to the Date of Birth attribute in eDirectory, and synchronize the same birth date for an individual in all 3 locations, as in the following:

Figure 5-21



You can configure the Schema Mapping rule in iManager:

Figure 5-22



You can also directly edit the XML document that describes the Schema Mapping rule:

**Figure 5-23**

```
<?xml version="1.0" encoding="UTF-8"?>
<attr-name-map>
  <!-- Schema mapping for User object. -->
  <class-name>
    <nds-name>User</nds-name>
    <app-name>inetOrgPerson</app-name>
  </class-name>
  <attr-name class-name="User">
    <nds-name>CN</nds-name>
    <app-name>cn</app-name>
  </attr-name>
  <attr-name class-name="User">
    <nds-name>uniqueID</nds-name>
    <app-name>uid</app-name>
  </attr-name>
  <attr-name class-name="User">
    <nds-name>Given Name</nds-name>
    <app-name>givenname</app-name>
  </attr-name>
</attr-name-map>
```

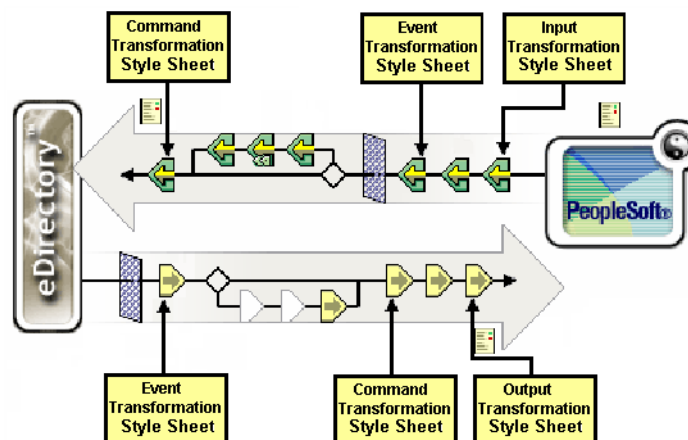
The same Schema Mapping rule is used for both the Publisher and Subscriber channels.

## Transformation Style Sheets

Although Transformation style sheets can be an important part of an Nsure solution, they are not covered in the course exercises.

The following shows the types of transformation style sheets available and where they process data in the Publisher and Subscriber channels:

Figure 5-24



The following types of transformation style sheets are available:

- **Data Transformation Style Sheets (Input and Output).** Data transformation style sheets solve the problem of applications that use different representations for the same data (15.2.1965 vs. 2/15/65).

Data transformation style sheets transform the data format of event data to match the format of the receiving application.

For example, the telephone number for a User object can be stored in an 800.555.1212 format in eDirectory, in an (800) 555-1212 format in a Human Resources database, and in an 800/555/1212 format in an email database.

Through data transformation style sheets, a change to the 800.555.1212 phone number in eDirectory can be synchronized in the correct format in the Human Resources and email databases.

- **Event Transformation Style Sheets.** Event transformation style sheets look for specific events and perform preliminary transformations on them.

Events pass through the Subscriber or Publisher channel as XML event documents. Using an Event transformation style sheet, these events are changed to a different event type.

For example, a Create event in eDirectory might actually be transformed to an Add event, or a Disabled event in one system might be transformed to a Delete event in eDirectory.

- **Command Transformation Style Sheets.** Command transformation sheets provide additional transformation an add event is processed.

A Command transformation style sheet can apply to the Subscriber channel or Publisher channel only, or both.

Command transformation style sheets are commonly used for the following tasks:

- Implementing custom command filtering

- ❑ Filtering out synchronization of attributes only used for control purposes
- ❑ Implementing custom commands
- ❑ Changing the results of an attribute merge

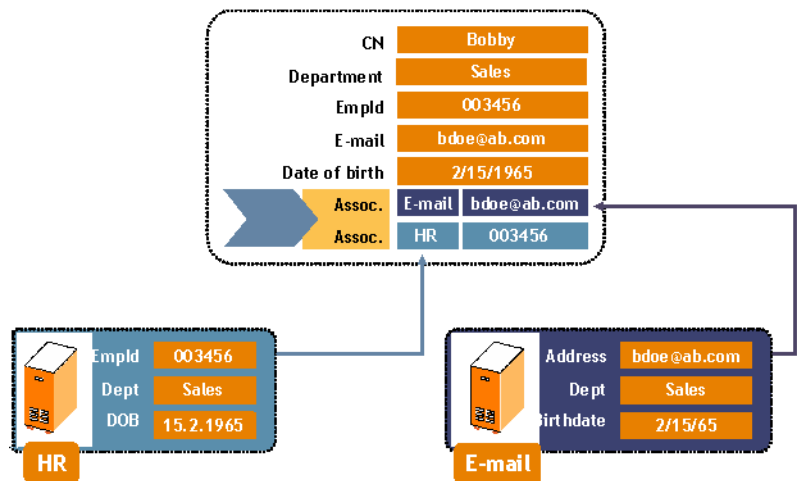
Usually the Subscriber and the Publisher channels use different Command transformation style sheets.

### **Associations**

Associations are created when the Matching rule determines that a new object needs to be created.

An association solves the problem of different systems having different unique identifiers for the same object:

**Figure 5-25**



Each object in eDirectory contains an association table that maps the eDirectory object with a unique identifier for each connected directory or application:

**Figure 5-26**

**Modify Object:** CGrayson

Associations

Driver Object	Associated Object ID	State
eDIR-Driver: DirXML Drivers.del	{C0C058CC-D513-d801-8062-000BC}	Processed

Add  
Edit  
Remove

When DirXML is initially installed, the eDirectory schema is extended on NetWare®, Windows® NT®/2000, and Solaris® or Linux (from NNLS) to include an attribute in the base class of all objects for the association table.

This table is built and maintained automatically so there is rarely a reason to edit this information manually, although it is often helpful to view this information.



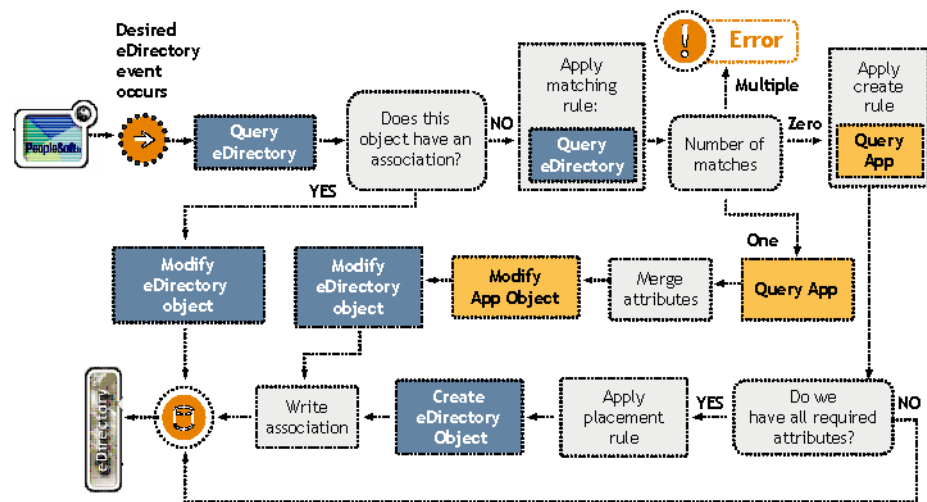
The table is reverse-indexed so that the connected application does not need to supply an eDirectory identifier (such as a distinguished name) to the integration driver when updating eDirectory.

An association is created when an event occurs to an object in a connected directory or application that has not yet been associated with another object in eDirectory.



The following shows the process of building an association on the Publisher channel:

Figure 5-27



The Matching, Creation, and Placement rules work together to create an association:

- An event (such as adding an employee) occurs in the application.
- If there is no association with an eDirectory user object, the criteria in the Matching rule determines if a user object in eDirectory matches the employee.

For example, if the Matching rule criteria indicates that the full name, title, and date of birth need to match, an association is not created unless all 3 are present and exactly the same.

- If there is not a match, the Creation rule determines if there is enough information about the employee to create an associated user object in eDirectory.

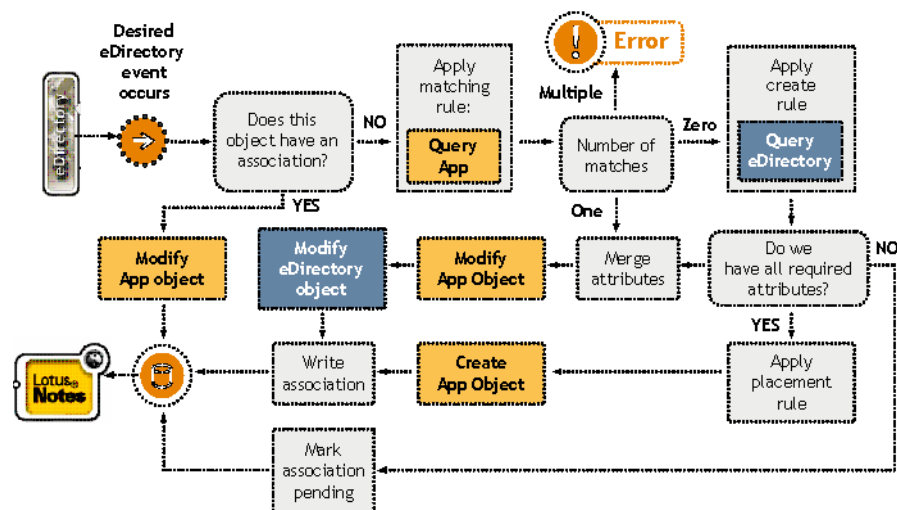
For example, the Creation rule might indicate that there needs to be at least a full name and title available to create a user object to associate with the employee.

- If there is not enough information, no user object is created.
- If there is enough information, the Placement rule indicates where to create the user object in the eDirectory tree, and the user object is created and associated with the employee in the application.

After an association has been created, the Matching, Creation, and Placement rules are no longer needed. The association is used to synchronize changes between the employee in the application and the user object in eDirectory.

The following shows the process of building an association on the Subscriber channel:

Figure 5-28







After an association between objects is formed, this association remains in effect until the objects are deleted or the association is deleted by an eDirectory administrator.



### ***DirXML Objects in eDirectory***

DirXML components are represented as objects in the eDirectory tree. These objects include the following:

**Table 5-2**

<b>Object</b>	<b>Description</b>
 Driver Set	<p>A driver set is a container that holds DirXML drivers. Only one driver set can be active on a server at a time.</p> <p>As a result, all active drivers must be grouped into the same driver set.</p>
 Driver	<p>A DirXML driver object represents a driver that connects to an application that integrates with eDirectory.</p>
 Rule	<p>DirXML rule objects define the criteria for data exchanges. DirXML includes Matching, Creation, Placement, and Schema Mapping rules.</p> <p>Transformation rules are stylesheets that transform the data being synchronized.</p> <p>Each driver comes with a default set of rule definitions that you can modify to meet the data-sharing requirements of your environment.</p>
 nadPwdSync	<p>This object represents a Novell Active Directory (nad) PasswordSync Agent.</p> <p>The agent uses this object to authenticate to eDirectory and gain access to other objects including users, nadDomains, and servers participating in password synchronization.</p>

**Table 5-2**

Object	Description
 nadPwdProvider	This object provides the connection between a Novell Active Directory (nad) PasswordSync Agent (represented as the parent nadPwdSync Object) and a domain. It holds domain-specific information required by the agent.
 nadDomain	The nadDomain object describes a single NT or Active Directory domain. Each nadDomain object holds a DirXML association with the DirXML driver that controls the domain.

**10 minutes**

### **Exercise 5-1    Confirm Installation of the DirXML Starter Pack on Your NNLS Server**

As network administrator for your Digital Airlines office, you have been assigned to synchronize all user and group objects in your tree with an EMPLOYEES container and a GROUPS container in an eDirectory tree at another Digital Airlines office. Both offices will be using the pre-configured eDirectory driver.

Before you create your eDirectory driver, you would like to confirm that the DirXML Starter Pack for Linux installation was successful on your NNLS server.

Do the following:

1. From your NNLS server, open a terminal session.
2. Log in as root by entering **su -** and a password of **novell**.
3. Change to the `/usr/lib/dirxml` directory by entering the following:

**cd /usr/lib/dirxml**

4. Display the files in the directory by entering **ls -al**.

Notice that there is a `rules` directory. This directory stores the files necessary for creating DirXML drivers.

5. Display the files for the eDirectory driver by entering **cd rules/nds2nds**; then enter **ls -al**.

Several XLF files (in various languages) help prompt you during driver creation. There is also an `eDir-Driver.xml` file you select to import and create your eDirectory driver.

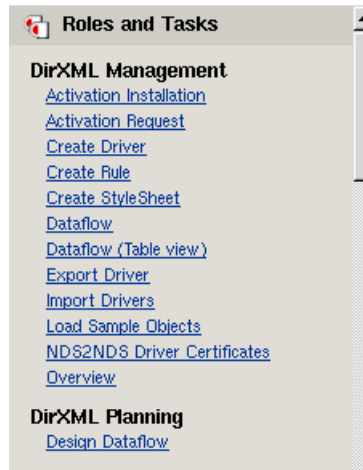
6. End the root session by entering **exit**; then close the terminal session window.

Now that you've seen the location of some of the DirXML files, let's open iManager and make sure the plugins for DirXML are installed.

7. Open Mozilla and enter the following URL to access iManager:  
**[https://DAX.your\\_container.digitalairlines.com/nps/iManager](https://DAX.your_container.digitalairlines.com/nps/iManager)**
8. Log in as **admin** with a password of **novell**.

At the left you should see 2 roles (DirXML Management and DirXML Planning) with several available tasks:

Figure 5-29



This indicates that the DirXML plugins have been installed.

9. Log out of iManager by selecting the **Exit** icon (top of the page); then close the Mozilla browser.

Now that you've checked the installation of DirXML on your server, you are ready to install the eDirectory driver for your tree.

*(End of Exercise)*

### Objective 3      Install the DirXML Starter Pack on Linux

To install the DirXML Starter Pack on Linux, you need to understand the following:

- What the DirXML Starter Pack Is
- How to Install the DirXML Starter Pack on Your Linux Server

#### *What the DirXML Starter Pack Is*

When you install DirXML from Novell Nterprise Linux Services (NNLS), you are installing the DirXML Starter Pack that includes the DirXML engine for Linux.



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Also included with NNLS 1.0 is an *NNLS - Companion* CD that has the DirXML engine for Windows. You install this starter pack separately.

---

The DirXML Starter Pack provides the following:

- **Licensed drivers.** You can install licensed drivers for synchronization of information in NT Domains, Active Directory, and eDirectory.  
  
Even though the drivers are licensed, you still need to submit a Product Activation Request within 90 days to prevent the drivers from shutting down.
- **Evaluation drivers.** In addition to the licensed drivers in the DirXML Starter Pack, other drivers are included for your evaluation, such as the following:
  - DirXML Driver for LDAP
  - DirXML Driver for JDBC™
  - DirXML Driver for Delimited Text
  - DirXML Driver for PeopleSoft
  - DirXML Driver for SAP®

- ❑ DirXML Driver for GroupWise®
- ❑ DirXML Driver for Exchange
- ❑ DirXML Driver for Lotus Notes
- ❑ DirXML Driver for SIF™

These drivers are fully functional, separately licensed drivers that let you explore data synchronization for your other systems.

You can install the evaluation drivers and test them with your own data. However, unless you purchase and activate them, the evaluation drivers will stop working 90 days after installation.

If you decide not to purchase an evaluation driver that you have tested, you should uninstall it and reverse any data changes resulting from your use of the driver.



Evaluation drivers are not provided as product updates. To download patches and fixes for DirXML drivers, visit “Product Updates” at <http://support.novell.com/filefinder/5069/index.html>.

---

- **Password synchronization.** The DirXML Starter Pack also gives you the ability to synchronize user passwords with PasswordSync.

With PasswordSync, a user is required to remember only a single password to log in to any of these systems.

Administrators can manage passwords in the system of their choice. Any time a password is changed in one of these environments, it will be updated in all of them.



PasswordSync is currently available only for Windows 2000/NT/XP. The computer where the PasswordSync agent is installed must have the latest Novell Client installed.

---

In this section, you install, configure, and test the eDirectory driver.





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For more information about the DirXML Starter Pack (including PasswordSync, the NT Domain driver, the Active Directory driver, and other evaluation drivers), see the Novell DirXML Starter Pack installation guide at <http://www.novell.com/documentation/lg/nw65/index.html>.

---

### ***How to Install the DirXML Starter Pack on Your Linux Server***

To install the DirXML Starter Pack on your Linux server, you need to know how to do the following:

- Meet DirXML Dependencies
- Gather Required Information
- Use the NNLS Install Feature
- Locate DirXML Files

#### **Meet DirXML Dependencies**

DirXML is dependent on the following NNLS components being installed on the same server:

- Apache 2.0.45
- JVM™
- Tomcat 4
- iManager 2.0.2
- eDirectory 8.7.3

If these components are not already installed, you have to install them when installing DirXML.

The NNLS install program will select the required components, along with their dependencies, when you select the DirXML component. They will all be installed in the same process.

See Table 2-4 for information needed to successfully install any DirXML dependencies that are not already installed.

### Gather Required Information

The following table describes the information needed to successfully install iFolder:

**Table 5-3**

Configuration Data Required	Description
Tree Name	The name of the eDirectory tree that DirXML will work with.
Admin Name with Context	The fully distinguished name of the Admin for the eDirectory tree specified for DirXML.  The name and context must be specified using typeful syntax ( <i>cn=name.ou=organizational-unit.o=organization</i> ).
Admin Password	The password for the Admin.

### Use the NNLS Install Feature

To install DirXML Starter Pack with NNLS, do the following:

1. Perform the steps to do a custom install.



If necessary, see Section 2 for details on how to perform a custom install.

2. Deselect the services you *do not want* to install, select the DirXML service; then continue.

If eDirectory has not previously been installed, notice that it is selected by default when you select DirXML (along with other required components such as Apache and Tomcat).

If eDirectory has been previously installed, the install program will indicate which components are already installed.

3. Accept the license agreement.
4. (Conditional) If prompted for the location of the NICI Foundation Key (NFK) file, enter the path to the NFK file.  
  
You will only be asked for the NICI Foundation Key if eDirectory has not previously been installed.
5. Enter the information requested at each prompt (see Table 5-3).
6. View the summary information and make any necessary corrections.
7. When all the information is correct, finish the installation.
8. View the readme file and save the installation settings log file.

### Locate DirXML Files

During a default installation, DirXML files are copied to the following directories:

- /usr/lib/dirxml/classes
- /usr/lib/dirxml/rules
- /var/opt/novell/tomcat4/webapps/nps/DirXML.Drivers

The **/usr/lib/dirxml/classes** directory contains the .jar files for the DirXML components.

The `/usr/lib/dirxml/rules` and `/var/opt/novell/tomcat4/webapps/nps/DirXML.Drivers` directories contain the preconfigured licensed and evaluation DirXML drivers.

## Objective 4    **Implement the Delimited Text Driver for DirXML**

To implement the Delimited Text driver for DirXML, you need to know the following:

- How the DirXML Driver for Delimited Text Works
- How to Create and Start the DirXML Driver for Delimited Text

### ***How the DirXML Driver for Delimited Text Works***

The DirXML driver for Delimited Text is designed to synchronize user data between Novell eDirectory and XML files or delimited text files that contain comma-separated values (CSV files).

This driver is different from other DirXML driver because it does not interface directly with any particular application. Text files take the place of the application.



Using your own style sheets, you can enable the driver to work with virtually any text-based file that contains predictably repeatable patterns.

---

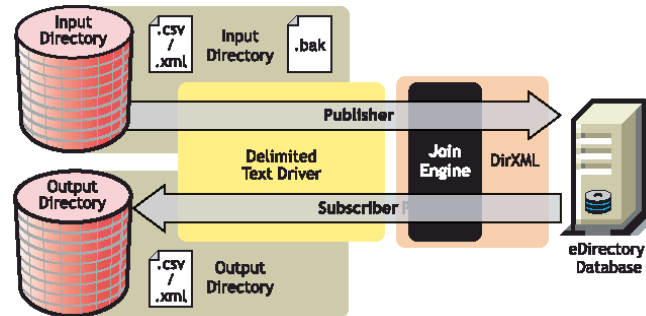
To understand how the driver works, you need to know the following:

- Default Driver Configuration
- Default Rules and Style Sheets

## Default Driver Configuration

The Delimited Text driver supports both the Publisher and Subscriber channels as illustrated in the following:

Figure 5-30



The following describes how each channel processes CSV files under the default configuration:

- **Publisher channel.** The Publisher channel reads information from input text files on your local file system and submits that information to eDirectory via the DirXML engine.

By default, the Publisher channel checks the input directory every 10 seconds. It processes any files with a .csv extension and then changes the file extensions to .bak. It cycles through this process until you manually stop the driver.

- **Subscriber channel.** The Subscriber channel watches for additions and modifications to eDirectory objects and creates output files on your local file system that reflect those changes.

By default, the Subscriber channel keeps an output file open until either 200 transactions have been logged or 30 seconds have elapsed.

When either of these parameters is reached, the output file is saved with a **number.csv** filename and a new output file is opened.

## Default Rules and Style Sheets

Rules and style sheets are used to control data synchronization between the driver and eDirectory. The Delimited Text driver comes with the set of preconfigured rules and style sheets described in the following:

**Table 5-4**

Rule or Style Sheet	Description
Schema Map	<p>Configured on the driver object.</p> <p>Maps eDirectory User properties to application attributes as follows:</p> <ul style="list-style-type: none"><li>■ Surname &gt; LastName</li><li>■ Given Name &gt; FirstName</li><li>■ Title &gt; Title</li><li>■ Internet EMail Address &gt; Email</li><li>■ Telephone Number &gt; WorkPhone</li><li>■ Facsimile Telephone Number &gt; Fax</li><li>■ mobile &gt; WirelessPhone</li><li>■ Description &gt; Description</li></ul> <p>The application attributes correspond to the sequence of values in the file or, if present, to the attributes associated with unnamed XDS &lt;field&gt; elements.</p>

**Table 5-4**

<b>Rule or Style Sheet</b>	<b>Description</b>
Input Transform	<p>Configured on the driver object.</p> <p>If the input document is an XML document, no transformations are made.</p> <p>If the document is a delimited text file (such as a CSV file), each record is transformed into an XDS add element for User objects with attributes defined by the schema map.</p> <p>The user CN is formed by concatenating the values of first name and last name.</p> <p>Associations are defined by the user's email attribute value.</p>
Output Transform	<p>Configured on the driver object.</p> <p>Specifies that a comma will be used as the delimiter character for output files and that the file format is CSV.</p>
Create	<p>Configured on the Publisher channel.</p> <p>Specifies that in order for a User to be created in eDirectory, the Given Name and Internet EMail Address attributes must be defined.</p>
Matching	<p>Configured on the Publisher channel.</p> <p>Specifies that a user in eDirectory is the same user specified in the input file when the value of Internet Email Address is the same in both places.</p> <p>In the case of a match, only changed attributes are updated in eDirectory.</p>

**Table 5-4**

Rule or Style Sheet	Description
Placement	<p>Configured on the Publisher channel.</p> <p>Specifies that a new user will be placed in the Users\Active container (or the container you specify during installation) and named with the CN created by the Input Transform rule.</p> <p>You need to create a Users\Active container (or your own container) the root of your tree before you start the driver.</p>
Event Transform	<p>Configured on the Subscriber channel.</p> <p>If eDirectory reports a Modify or Sync event, those events are changed to an instance element that can be used to create a complete output record.</p>



These policies can be customized through Novell iManager as explained in Chapter 3, “Customizing the DirXML Driver for Delimited Text,” of the Novell DirXML Driver for Delimited Text Implementation Guide

You can access the guide from <http://www.novell.com/documentation>.

### ***How to Create and Start the DirXML Driver for Delimited Text***

The Delimited Text driver files are copied to your Linux server when you install DirXML using the NNLS installation.

However, you still need to create and configure the Delimited Text driver before you can begin synchronizing data between eDirectory and the driver.

To create and start your Delimited Text driver, you need to know how to do the following:



- Create and Start the Delimited Text Driver
- Activate the Driver

### Create and Start the Delimited Text Driver

To create and start the Delimited Text driver on your Linux server, do the following:

1. Start a web browser (such as Mozilla).
2. Enter the following URL to access iManager:  
**http://your\_server\_IP\_address/nps/iManager**
3. Log in using your administrator user name and password.
4. Select **DirXML Management > Create Driver**.
5. Select **In a new driver set**; then select **Next**.
6. Enter the following new driver set properties:
  - **Name:** This is the name you want to give the Driver Set object that stores your Delimited Text driver files (and any other drivers you install on the server).
  - **Context:** This is the container in which you want to create the Driver Set object. You need to provide the full context (such as **DEL.DA**).
  - **Server:** The server you want to associate with the drivers you install.
7. Make sure **Create a new partition on this driver set** is selected; then select **Next**.



---

Although creating a new partition is not necessary, we recommend partitioning the DirXML driver set so that if replicas of users are moved to another server, the driver objects are not moved.

---

The driver set and partition are created.

A page for importing or creating a driver appears.

8. Make sure **Import a pre-configured driver from the server (.XML file)** is selected.
9. From the drop-down list, select **DelimitedTextCSVSample.xml**; then select **Next**.  
A Delimited Text driver configuration page appears.
10. In this page, you need to enter the following information:

**Table 5-5**

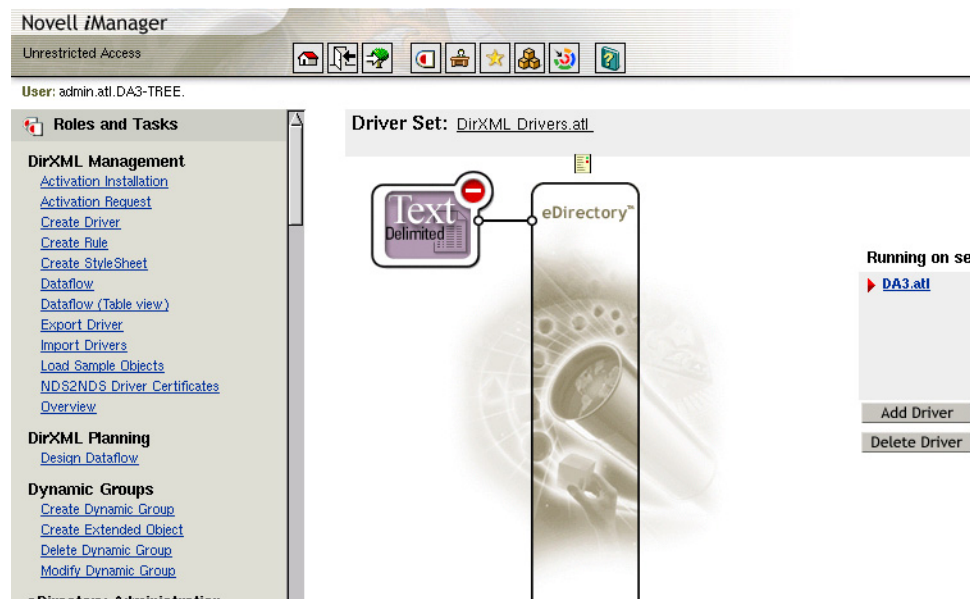
Option	Description
Driver name	The actual name you want to use for the driver.
Output Directory	Enter the platform specific path to the local directory where output files should be created.
Input Directory	Enter the platform specific path to the local directory where input files will be found.
User Container	Enter the DN (in slash form) of the container where new users are to be placed.  Example: <b>novell\active\users</b>

11. When you finish entering the configuration information, select **Next**.
12. Assign the necessary rights to the Delimited Text driver to read and update data in eDirectory:
  - a. Select **Define 'Security Equivalences'**; then select **Add**.
  - b. Browse to and select an **administrator object** with sufficient rights to manage the tree.
  - c. Select **OK**.

13. Exclude the **administrator object** from being replicated to the other (remote) tree:
  - a. Select **Exclude 'Administrative Roles'**; then select **Add**.
  - b. Browse to and select the **administrator object**.
  - c. Select **OK**.
14. Continue by selecting **Next**.


A Summary page appears.
15. Select **Finish with Overview**.

A DirXML overview page appears:

**Figure 5-31**

From this page you can start and stop the Delimited Text driver (the minus sign in the red circle indicates the driver is stopped). You can also view the name of the driver set and the server associated with the driver.

16. Start the driver by selecting the **red circle** icon; then select **Start driver**.

After a few moments, the driver starts. A Yin-Yang icon  replaces the red circle.

You have finished installing and starting the Delimited Text driver.

### Activate the Driver

Even though the Delimited Text driver included with NNLS starts, you still need to activate it within 90 days of installation, or it will shut down.

At any time during the 90 days, or afterward, you can choose to activate the driver to a fully licensed state.

To activate your driver, you need to

1. Generate a Product Activation Request.
2. Submit the Product Activation Request.
3. Install the Product Activation Credential received from Novell.

Creating a Product Activation Request and installing the Product Activation Credential can be done from iManager.



---

For information on completing these tasks, refer to “Appendix A: Activating Novell DirXML Products” in the Novell DirXML Starter Pack installation guide at <http://www.novell.com/documentation/lg/nw65/index.html>.

---

**25 minutes****Exercise 5-2    *Install and Test Your Delimited Text Driver***

Digital Airlines has purchased a flight operations company. During the transition, you need to include the flight operations employee information in your eDirectory tree, and the flight operations company needs to incorporate Digital Airlines employee information into their database system.

The flight operations company database application that stores employee information is older software and is not LDAP-enabled. However, you can export and import employee information in a comma-separated value files (CSV).

You decide to use the CSV capabilities of the DirXML Delimited Text Driver to import the flight operations employee data into your eDirectory tree, and to export your office employees as a CSV file for the flight operations company to use.

To accomplish this, you do the following:

- Part I: Prepare for Installing the Delimited Text Driver
- Part II: Create and Configure the Delimited Text Driver
- Part III: Explore Your Delimited Text Driver
- Part IV: Start and Test the Delimited Text Driver

**Part I: Prepare for Installing the Delimited Text Driver**

Before installing and using the Delimited Text driver, you need to perform several tasks such as creating input and output directories.

For your Digital Airlines office, you decide to create input and output directories in your /tmp folder and create a Flightops organizational unit container in your eDirectory tree to store the flight operations employees.

Do the following

1. Make sure you are logged in as **student** with a password of **novell**.
2. From your NLLS server desktop, open a terminal session.
3. At the shell prompt, create a /tmp/dirxml/input directory by entering **mkdir -p /tmp/dirxml/input**.
4. Verify that the /tmp/dirxml/input has been created by entering **ls -l /tmp/dirxml/input**.

You see a total of 0 files in the directory.

5. Create a /tmp/dirxml/output directory by entering **mkdir -p /tmp/dirxml/output**.
6. Verify that the /tmp/dirxml/output has been created by entering **ls -l /tmp/dirxml/output**.

You see a total of 0 files in the directory.

With the input and output directories created for importing (input) and exporting (output) CSV files, you are ready to create the eDirectory container for importing the flight operations employees.

7. Open iManager by selecting the **Mozilla 1.5** icon, and then entering **https://DAx.your\_container.digitalairlines.com**.
8. Log in as **admin** with a password of **novell**.
9. On the left under eDirectory Administration, select **Create Object**.
10. On the right under Available object classes, select **Organizational Unit**; then select **OK**.
11. Enter the following:
  - Organizational Unit name: **Flightops**
  - Context: **your\_container**
12. When you finish, select **OK**.

## Part II: Create and Configure the Delimited Text Driver

Now that you've prepared the directories and eDirectory container for importing and exporting employees, you are ready to install and configure the Delimited Text driver.



If you have problems creating the Delimited Text driver with iManager on Mozilla 1.5, try using Internet Explorer on your Windows XP desktop.

In this step students check the date and time on their NNLS servers to make sure that the date and time are current.

The date should be current (today's date). If not, and the date is more than 90 days in the past, students can import the driver, but it will not work until it is activated.

Do the following:

1. Check to make sure the date and time on your NNLS server are current:
  - a. In the terminal session window at the shell prompt, enter **date**.  
The date and time should be current (today's date and time). If not, you can create the Delimited Text driver, but will not be able to use it if the date is 90 days or more prior to the current date.
  - b. Do the following:
    - a. If the date is current, continue with the exercise (step 2).
    - b. If the date is not current, log in as root (**su -**), stop the NTP daemon (**/etc/init.d/xntpd stop**), update your server date and time to DA1 (**ntpdate 10.0.0.1**), and start the NTP daemon (**/etc/init.d/xntpd start**).
    - c. Check the date and time by entering **date**. If the date is current, continue with step 2.
    - d. If the date is still not current, *contact your instructor for additional help*.
2. From iManager on the left under DirXML Management, select **Create Driver**.
3. Make sure **In a new driver set** is selected; then select **Next**.

4. Enter the following:

- ❑ Name: **DirXML Drivers**
- ❑ Context: *your container*
- ❑ Server: *your server.your container*

Use the **Select Object** icon (magnifying glass) to browse to and select the Context and Server. Entering these from the keyboard can cause errors.

5. Make sure **Create a new partition on this driver set** is selected; then continue by selecting **Next**.
6. From the drop-down list under “Import a pre-configured driver from the server,” select **DelimitedTextCSVSample.xml**.
7. Continue by selecting **Next**.

A driver configuration page appears.

8. Enter the following information:

- ❑ Driver name: **Delimited Text**
- ❑ Output files: **/tmp/dirxml/output**
- ❑ Input files: **/tmp/dirxml/input**
- ❑ New users container: *your container*\Flightops

Make sure you use the slash (/) for Output files and Input files, and the backslash (\) for New users container.

9. When you finish, select **Next**.



Some students might skip over this step (Define 'Security Equivalences'). Without admin defined, the Delimited Text driver will not synchronize data, even if the student can start the driver.

You can add admin as a security equivalent after the driver is created by modifying the properties of the Delimited Text object (DirXML: Security Equals).

10. Assign the necessary rights to the Delimited Text driver to read and update data in eDirectory:
  - a. Select **Define 'Security Equivalences'**; then select **Add**.
  - b. Browse to and select **admin.your container**.
  - c. Select **OK**.
11. Exclude admin from being exported to a CSV file:
  - a. Select **Exclude 'Administrative Roles'**; then select **Add**.
  - b. Browse to and select **admin.your container**.
  - c. Select **OK**.
12. Continue by selecting **Next**.  
A Summary page appears.
13. Select **Finish with Overview**.  
A DirXML overview page appears:

Figure 5-32



This page lets you start and stop the Delimited Text driver, and view the name of the driver set and the server associated with the driver.

The minus sign in the red circle indicates the driver is stopped.

### Part III: Explore Your Delimited Text Driver

Before starting the Delimited Text driver, you decide to check the driver objects and some of the driver rules.

Do the following:

1. At the left under eDirectory Administration, select **Modify Object**.
2. At the right of the Object Name field, select the **Object Selector** icon (magnifying glass); then select **Browse**.
3. Browse to and view the contents of **DirXML Drivers** in *your container*.

You might need to select the **Next** button several times before finding DirXML Drivers.

A Delimited Text object appears. This is the driver that you imported and configured.

4. View the contents of the **Delimited Text** container (select the blue down-arrow to the left of the container name).

You see the following:

- Publisher container
- Subscriber container
- InputTransformSS object
- OutputTransformSS object
- MappingRule

The Input transformation style sheet transforms the comma-separated data for each record in a CSV file to an XDS add element that can be used by eDirectory to create user objects.

The Output transformation style sheet transforms user data coming from eDirectory to a CSV file format.

The Schema Mapping rule (MappingRule) defines the order of values in a CSV text file or the attributes associated with an XDS field element.

5. View the contents of the **Publisher** container.

You see objects for the Create rule, Matching rule, and Placement rule. These are the same rules you saw listed in the Summary screen when you imported and created the driver.

These rules are used to create and place users in your tree coming from the CSV file.

6. Browse to and view the contents of the **Subscriber** container.

You see an Event Transformation style sheet (SubscribeEventTransformSS) which is used to create a complete user record in a CSV file for a user object exported from eDirectory.

7. When you finish, select **Cancel**.

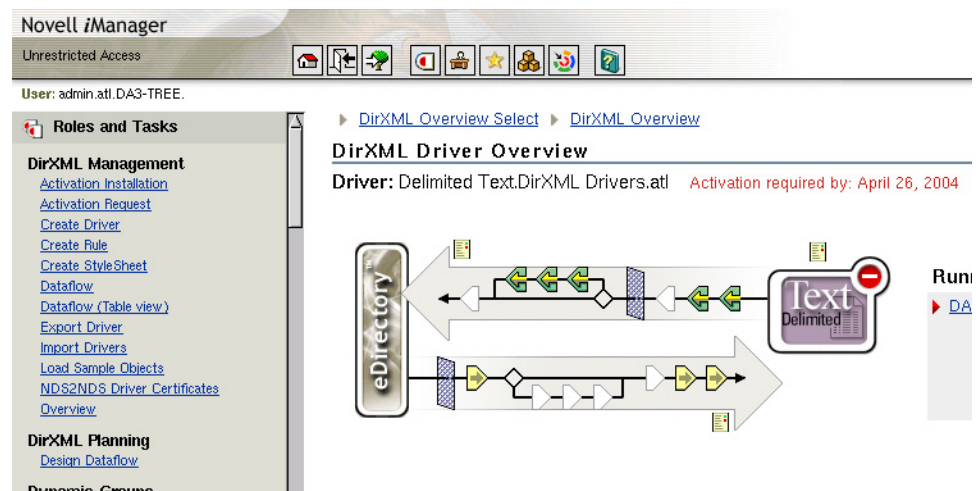
8. On the left under DirXML Management, select **Overview**; then select **Search**.

The DirXML Overview page appears:

9. Select the **Delimited Text** driver icon (do not select the red circle).

The DirXML Driver Overview page appears for the Delimited Text driver:

**Figure 5-33**



From this page you can tell that there are Placement, Creation, and Matching rules and style sheets defined for the Publisher channel, and you can see the order in which they process data flowing on the Publisher channel (input).

You can also see the style sheets for the Subscriber channel, and access the Publisher and Subscriber filters on your Delimited Text driver.

Let's take a look at the Matching, Creation, and Placement rules configured on the Publisher channel.

The information that flows through the Publisher filter is used by these rules to determine

- ❑ If an object already exists in your eDirectory tree that matches the one in the CSV file (Matching rule)
- ❑ If enough information passed through the filter to create a new user object (Creation rule)
- ❑ Where to place new user objects in your eDirectory tree (Placement rule)

Let's take a look at the Creation rule.

10. On the Publisher Channel, select the **Creation Rule** icon.

A Creation Rule dialog appears.

11. At the top of the dialog from the drop-down list, select **Edit XML**.

The XML document for the Creation rule appears:

**Figure 5-34**

XML Editor:

```
<?xml version="1.0" encoding="UTF-8"?>
<create-rules>
  <create-rule class-name="User">
    <required-attr attr-name="Given Name"/>
    <required-attr attr-name="Internet EMail Ac
  </create-rule>
</create-rules>
```

What 2 attributes are required to create a user object in your eDirectory tree?

A Given Name and an Internet email address are required.

Values for these attributes need to exist in the CSV file and be selected in the Publisher filter to create an user object in your eDirectory tree.

12. Close the Creation Rule dialog by selecting **Cancel**.
13. On the Publisher Channel, select the **Placement Rule** icon.  
A Placement Rule dialog appears.
14. Select **Placement Rule**; then, from the drop-down list, select **Edit XML**.

An XML document similar to the following appears:

**Figure 5-35**

XML Editor:

```
<?xml version="1.0" encoding="UTF-8"?>
<placement-rules dest-dn-format="slash" src-dn-format="slas
  <placement-rule>
    <match-class class-name="User"/>
    <placement>atl\Flightops\<copy-name/>
  </placement>
</placement-rule>
</placement-rules>
```

Where does the placement rule place users coming from the CSV file to your eDirectory tree?

Users are placed in ***your container.Flightops*** (the container you specified when installing the driver).

15. Close the Placement Rule dialog by selecting **Cancel**.
16. On the Publisher Channel, select the **Matching Rule** icon.  
A Matching Rule dialog appears.
17. Select **Matching Rule**; then, from the drop-down list, select **Edit XML**.

An XML document similar to the following appears:

**Figure 5-36**

XML Editor:

```
<?xml version="1.0" encoding="UTF-8"?>
<matching-rules>
  <matching-rule>
    <match-class class-name="User"/>
    <match-attr attr-name="Internet EMail Address"/>
  </matching-rule>
</matching-rules>
```

What information does the matching rule use to determine if a user already exists in the eDirectory tree?

The matching rule looks for a user object and compares the incoming Internet email address to the email addresses for all user objects.

If there is a match, the creation and placement rules are ignored, and the matching user object is updated with information coming from the CSV file.

Because the flight operations company uses a different domain for email addresses, there should be no chance of a match being found between existing Digital Airlines employees and employees being imported from the CSV file.

18. Close the Matching Rule dialog by selecting **Cancel**.

## Part IV: Start and Test the Delimited Text Driver

With the Delimited Text driver installed and configured, you are ready to start and test the driver.

Do the following;

1. Start the driver by selecting the red circle with a white dash; then select **Start driver**.

After a few moments, a Yin-Yang icon replaces the red circle, indicating that the driver is running.

2. Test importing flight operations users into your eDirectory tree:

For this exercise, we'll use the *sample.csv* file that comes with the Delimited Text driver to import users into your eDirectory tree.

Do the following:

- a. In a terminal session window, change to the directory where the *sample.csv* file is located by entering **cd /usr/lib/dirxml/rules/delim/**.
- b. Copy the **sample.csv** file to the */tmp/dirxml/input* directory by entering **cp sample.csv /tmp/dirxml/input**.

Because the Delimited Text driver checks the input directory every 10 seconds for a new CSV file, the import should already have started.

- c. Verify that the users have been placed in the Flightops container from iManager by selecting **Modify Object**.
- d. Browse to and display the contents of *your container.Flightops*.

Several screens of user objects are displayed.

The contents of *sample.csv* were processed through the Publisher channel and the user objects placed in the configured container.



3. Test exporting users from your eDirectory tree to a CSV file by doing the following:
  - a. On the left under DirXML Management, select **Overview**.
  - b. Select **Search**.

The DirXML Overview page appears with the Text Delimited icon.
  - c. Select the **Text Delimited** icon.

The DirXML Driver Overview page appears.
  - d. Select the **Migrate from eDirectory** button.

A Migrate data from eDirectory dialog appears.
  - e. Select the **Add** button; then browse to and select a user object in **Flights.your container**.

You are returned to the Migrate data from eDirectory dialog with the user object listed.
  - f. Use the **Add** button to add several more users to the list.
  - g. When you finish, select **OK**.

A dialog appears indicating that the migration was successfully started.
  - h. Select **OK**.
  - i. From a shell prompt, enter **cd /tmp/dirxml/output**.
  - j. Display the files in the output directory by entering **ls -l**.

Notice that a CSV file has been generated by the Delimited Text driver (using a randomly-generated number for the filename).
  - k. Display the contents of the file by entering **more filename.csv**.

A line is displayed for each user object that you exported from eDirectory. Each attribute value is separated by a comma.

You can use this file to import data into any program that accepts a CSV-formatted file, including the flight operations company database.

1. When you finish viewing the contents of the CSV file, close the terminal session window.
4. From the iManager DirXML Driver Overview window, stop the Delimited Text driver by selecting the Yin-Yang icon and selecting **Stop driver**.

After a few moments the driver stops and the red circle icon appears.

5. Exit iManager and close the Mozilla 1.5 browser window.

*(End of Exercise)*

## Objective 5 Implement the eDirectory Driver for DirXML

To implement the eDirectory driver for DirXML, you need to know the following:

- How the DirXML Driver for eDirectory Works
- How to Create and Configure the DirXML Driver for eDirectory

### *How the DirXML Driver for eDirectory Works*

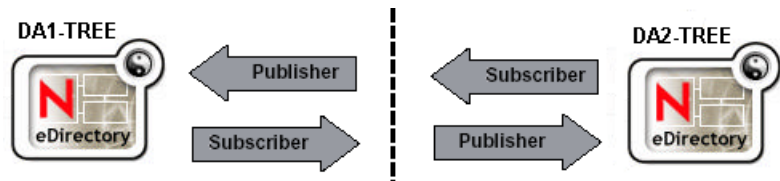
Comparing the eDirectory driver to an ethernet crossover cable can help students understand how data flows from one eDirectory tree to another.

The DirXML driver for eDirectory is designed to synchronize objects and attributes between different eDirectory trees (internal or external trees).

Because you are synchronizing data between eDirectory trees, you will always have 2 drivers installed, each in its own tree.

The Subscriber channel in one tree communicates with the Publisher channel in the other tree, as illustrated in the following:

Figure 5-37



For example, the Subscriber channel in DA2-TREE communicates with the Publisher channel in DA1-TREE.

This means that all data from DA2-TREE passes through the Subscriber filter for its own driver and the Publisher filter for the DA1-TREE driver before being processed by the Matching, Creation, and Placement rules for the DA1-TREE.

Before you configure the eDirectory driver, you need to understand the following information about how the driver works:

- Event Processing
- Object Placement
- Replicas and Data Synchronization

### Event Processing

How the events in one directory are handled in the other directory depends on which system you designate as the authoritative source:

- **One authoritative source.** If you specify a single directory, such as DA2-TREE, as the authoritative source, any DA2-TREE add, delete, and modify events are synchronized to DA1-TREE.

DA1-TREE events are not synchronized back to DA2-TREE. This happens because the Subscriber filter for the DA1-TREE driver is empty, effectively blocking all data flow from DA1-TREE to DA2-TREE.

- **Two authoritative sources (or bi-directional).** If you specify both directories as the authoritative source, any add, delete, and modify events are synchronized in both directories.

This means that an object deletion in DA1-TREE results in an object deletion in DA2-TREE. An object deletion in DA2-TREE results in an object deletion in DA1-TREE.

### Object Placement

During configuration, you also specify object placement. For synchronization with eDirectory, you have the following placement options:

- **Mirrored.** You specify a base container on the target tree; the hierarchy from the source tree is then mirrored inside the base container of the target tree.

The structure of the synchronized object's source DN will be reflected inside the base container of the target tree.

- **Flat.** You specify a base container for User objects and a base container for Group objects.

All synchronized user objects are placed directly in the base container for users, and all synchronized group objects are placed directly in the base container for groups.

- **Department.** You specify a base container on the target tree; then a synchronized object and its parent OU object are synchronized to the target base container.

For example, JBrown.DEL.DA for DA1-TREE would be synchronized into the target tree as

JBrown.DEL.*BaseContainer*.DA for DA2-TREE.

## Replicas and Data Synchronization

Because data in 2 Novell eDirectory trees is being synchronized, the engine and the eDirectory driver are installed on 2 separate servers in 2 separate trees.

For this reason the engine always needs to be on a server holding a writable replica (such as Read/Write or Master) of the data you will be synchronizing.

In addition, Novell recommends that the DirXML driver set object exist in a separate partition so that if replicas of users are moved to another server, the DirXML driver objects are not moved.



---

You can select an option to have the partition created for you when creating the driver set.

---

### ***How to Create and Configure the DirXML Driver for eDirectory***

The DirXML driver for eDirectory is unique among DirXML drivers because you always install 2 eDirectory drivers—1 for each tree.

The eDirectory driver files are copied to your Linux server when you install DirXML using the NNLS installation.

However, you still need to create and configure the eDirectory driver before you can begin synchronizing data between eDirectory trees.

To create and configure your eDirectory driver, you need to know how to do the following:

- Create and Start the eDirectory Driver
- Activate the Driver
- Configure Secure DirXML Data Transfers
- Configure the eDirectory Driver

#### **Create and Start the eDirectory Driver**

To create and start the eDirectory driver on your Linux server, do the following:

1. Start a web browser (such as Mozilla).
2. Enter the following URL to access iManager:  
**`http://your_server_IP_address/nps/iManager`**
3. Log in using your administrator user name and password.
4. Select **DirXML Management > Create Driver**.
5. Select **In a new driver set**; then select **Next**.
6. Enter the following new driver set properties:

- ❑ **Name:** This is the name you want to give the Driver Set object that stores your eDirectory driver files (and any other drivers you install on the server).
  - ❑ **Context:** This is the container in which you want to create the Driver Set object. You need to provide the full context (such as **DEL.DA**).
  - ❑ **Server:** The server you want to associate with the drivers you install.
7. Make sure **Create a new partition on this driver set** is selected; then select **Next**.



Although creating a new partition is not necessary, we recommend partitioning the DirXML driver set so that if replicas of users are moved to another server, the driver objects are not moved.

The driver set and partition are created.

A page for importing or creating a driver appears.

8. Make sure **Import a pre-configured driver from the server (.XML file)** is selected.
9. From the drop-down list, select **eDIR-Driver.xml**; then select **Next**.  
An eDIR-Driver configuration page appears.
10. In this page, you need to enter the following information:

**Table 5-6**

Option	Description
Driver name	The actual name you want to use for the driver.
Remote Tree Address and Port	Enter the DNS host name or IP address and port of the DirXML server in the remote tree (the tree you want to synchronize with).

**Table 5-6** *(continued)*

Option	Description
Configure Data Flow	<p>Select 1 of the following data flow options:</p> <ul style="list-style-type: none"> <li>■ <b>Bi-directional.</b> This means that both eDirectory trees are authoritative sources of the data synchronized between them.</li> <li>■ <b>Authoritative.</b> This means that the local tree will be the authoritative source. Any changes made in the local tree will be reflected in the remote tree.</li> <li>■ <b>Subordinate.</b> This means that the local tree is NOT an authoritative source. Changes made in the local tree WILL NOT be reflected in the remote tree.</li> </ul>
Configuration Option	<p>Choose 1 of the following placement options:</p> <ul style="list-style-type: none"> <li>■ <b>Mirrored.</b> This synchronizes objects hierarchically between the local and remote trees, and uses the NDSMIRROR.XML configuration file. Use this configuration when both trees are structured the same.</li> <li>■ <b>Flat.</b> This synchronizes all user and group objects into specific containers, and uses the NDSFLAT.XML configuration file. For example, if users in the local tree are stored in several containers, and you want them all synchronized to 1 container in the remote tree, use this option.</li> <li>■ <b>Dept.</b> This synchronizes Users and Groups by department, and uses the NDSDEPT.XML configuration file. The configuration files are located in the <b>/usr/lib/dirxml/rules/nds2nds</b> directory.</li> </ul>
Remote Base Container	<p>This is for a Mirrored configuration only.</p> <p>Enter the base container for synchronization in the remote tree.</p>



**Table 5-6** *(continued)*

Option	Description
Base Container	<p>This is for all configuration options (Mirrored, Flat, and Dept).</p> <p>Enter the base container for synchronization in the local tree.</p> <p>For Mirrored, this is the local base container to mirror with the remote base container. For Flat, this is the container to place users into. For Dept, this is the parent of the departmental containers.</p>
Group Container	<p>This is for a Flat configuration only.</p> <p>Enter the base container in the local tree from groups to be synchronized into from a remote Directory.</p>
Enable Password Sync	<p>Enable driver level support for password synchronization with Active Directory or NT domains.</p>
Driver set includes Active Directory or NT passwords	<p>Choose Yes if this is the tree that contains the driver set configured to synchronize Active Directory or NT passwords.</p>

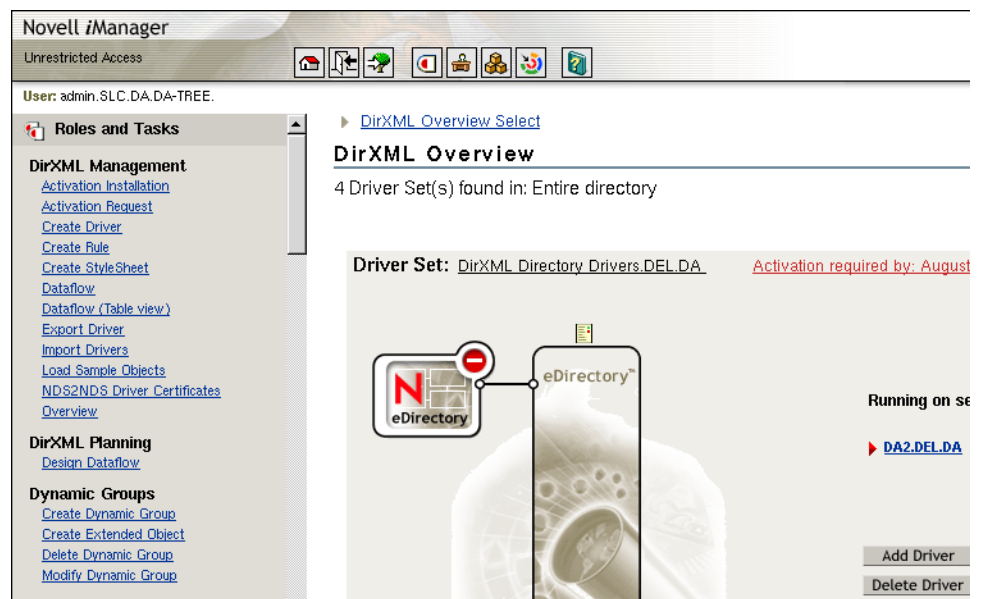
11. When you finish entering the configuration information, select **Next**.
12. Assign the necessary rights to the eDirectory driver to read and update data in eDirectory:
  - a. Select **Define ‘Security Equivalences’**; then select **Add**.
  - b. Browse to and select an *administrator object* with sufficient rights to manage the tree.
  - c. Select **OK**.

13. Exclude the **administrator object** from being replicated to the other (remote) tree:
  - a. Select **Exclude 'Administrative Roles'**; then select **Add**.
  - b. Browse to and select the **administrator object**.
  - c. Select **OK**.
14. Continue by selecting **Next**.

A Summary page appears.
15. Select **Finish with Overview**.


A DirXML overview page appears:

Figure 5-38



From this page you can start and stop the eDirectory driver (the minus sign in the red circle indicates the driver is stopped). You can also view the name of the driver set and the server associated with the driver.

- 16.** Start the driver by selecting the **red circle** icon; then select **Start driver**.

After a few moments, the driver starts. A Yin-Yang icon  replaces the red circle.

You have finished installing and starting the eDirectory driver.

### Activate the Driver

Even though the eDirectory driver included with NNLS is licensed, you still need to activate it within 90 days of installation, or it will shut down.

At any time during the 90 days, or afterward, you can choose to activate the driver to a fully licensed state.

To activate your driver, you need to

1. Generate a Product Activation Request.
2. Submit the Product Activation Request.
3. Install the Product Activation Credential received from Novell.

Creating a Product Activation Request and installing the Product Activation Credential can be done from iManager.



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For information on completing these tasks, refer to “Appendix A: Activating Novell DirXML Products” in the Novell DirXML Starter Pack installation guide at <http://www.novell.com/documentation/lg/nw65/index.html>.

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### Configure Secure DirXML Data Transfers

You can configure your Novell eDirectory system to handle secure DirXML data transfers using Novell iManager (or ConsoleOne).

The eDirectory driver uses Novell Certificate Server and a Certificate Authority (CA) to ensure data security.

All transactions between trees are secured through SSL technology.

Key Material Objects (KMOs) are used in eDirectory to store certificate and public/private key data. A minimum of 2 KMOs (1 KMO per tree) must be created for use with the eDirectory driver.

To use a certificate from 1 tree in another tree, the Trusted Root certificate from the first tree's Certificate Authority must be exported for use in the second tree.

The NDS2NDS Driver Certificate wizard in iManager walks you through the process of setting up the KMOs.



---

For information on securing your eDirectory driver data transfers, refer to “Configuring the DirXML Drivers” in the Novell DirXML Starter Pack installation guide at <http://www.novell.com/documentation/lg/nw65/index.html>.

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## Configure the eDirectory Driver

The following are examples of basic configuration tasks you might need to do to complete configuration of your eDirectory driver:

- Modify the Publisher and Subscriber Channel Filters
- Configure Rules on the Publisher Channel



---

To become skilled at configuring and implementing a DirXML driver in a production environment requires significant training and experience.

The installation and configuration tasks presented in this section provide some instruction in setting up a default configuration, which normally needs additional configuration skills to implement.

---

### Modify the Publisher and Subscriber Channel Filters

You should modify the filters on the Publisher and Subscriber channels to include object classes and attributes you want available (or removed) for DirXML processing.

To modify a filter:

1. In iManager, select **DirXML Management > Overview**.
2. Display the DirXML Driver Overview page by locating the driver set containing the eDirectory driver and selecting the driver's icon.
3. Display the Filter dialog by selecting the Publisher or Subscriber channel filter object.
4. Do one of the following:
  - If the filter is empty, add classes to the filter by selecting **The Filter is Empty**.
  - or*
  - If the filter is configured, select a listed class.

An Edit Filter dialog appears.

5. From the Edit Filter dialog, select a class you want to add to the filter or edit.
6. From the available attributes on the right, select (or deselect) the attributes you want to include (or remove) in the filter.
7. When you finish, select **Apply**; then select **OK**.

When configuring the Subscriber channel filter, you must select the GUID attribute. This is necessary for the eDirectory driver to work properly and for the object's association to be generated.

It is also recommended that you remove the ACL attribute from all filters to avoid synchronization problems.



---

Removing the ACL attribute is also recommended by Novell because it can contain tree-specific information that might block the synchronization of data through the channel.

---

### **Configure Rules on the Publisher Channel**

The rules on an eDirectory driver should generally be placed only on the Publisher channel, not on the Subscriber channel.

The Matching rule cannot operate correctly on the Subscriber channel because an association has not yet been set on the remote side object to match.

It is possible, however, to place a Creation Rule on the Subscriber side in order to prevent sending unnecessary data across the channel.

**1 hour 15 minutes**

### ***Exercise 5-3    Install and Test Your eDirectory Driver***

This exercise requires that students work in pairs to synchronize employees and groups between trees.

Table 5-7 lists suggested pairings of students. Student can also choose to partner with someone else.

If there is a student without a partner, have that student work through the exercise synchronizing to DA2.

You might want to help the student by partnering with him or her to do the setup work on DA2.

Most Digital Airlines employees work out of 2 branch offices (called partner offices), and need the same rights and access to applications and data in both offices.

Currently each office has its own eDirectory tree. To ensure that identical user objects exist in both partner office trees for the same employees, Digital Airlines has decided to use DirXML to synchronize these user objects and any associated group objects.

As administrator for your Digital Airlines office, you need to work with the administrator from your partner office to set up and test an eDirectory driver in each tree that synchronizes groups and employees from both offices.

To accomplish this, you and the other administrator do the following:

- Part I: Add Containers For Your Partner Office
- Part II: Create the eDirectory Driver for Your Tree
- Part III: Explore and Configure Your eDirectory Driver Rules and Filters
- Part IV: Synchronize Existing Users and Groups in Your eDirectory Tree to Your Partner Office DAX-TREE
- Part V: Use the Subscriber Filter to Limit Synchronized Data
- Part VI: Stop Your eDirectory Driver and Clean Up Your eDirectory Tree

The following are suggested partner offices for synchronizing employees and groups between eDirectory trees. However, you can partner with any other student in class:

**Table 5-7**

**Suggested Partner Offices**

ATL — DA3-TREE	BOI — DA4-TREE
BWI — DA5-TREE	DAY — DA6-TREE
DEL — DA7-TREE	DFW — DA8-TREE
GTF — DA9-TREE	IAD — DA10-TREE
IDA — DA11-TREE	LAX — DA12-TREE
LGA — DA13-TREE	LON — DA14-TREE
MCI — DA15-TREE	MEM — DA16-TREE
MIA — DA17-TREE	PDX — DA18-TREE
PHX — DA19-TREE	SYD — DA20-TREE
TXL — DA21-TREE	TYO — DA22-TREE

**Part I: Add Containers For Your Partner Office**

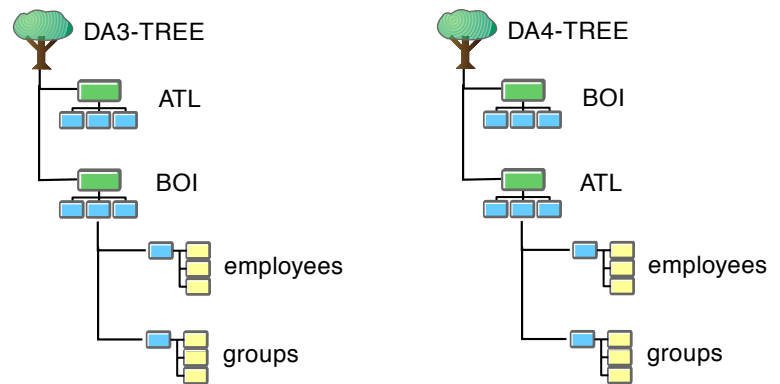
Before you create your eDirectory driver, you need to create containers for the employees and groups synchronizing from your partner office.

For example, if your office is ATL, and your partner office is BOI, you need to create containers for BOI employees and groups in your eDirectory tree.



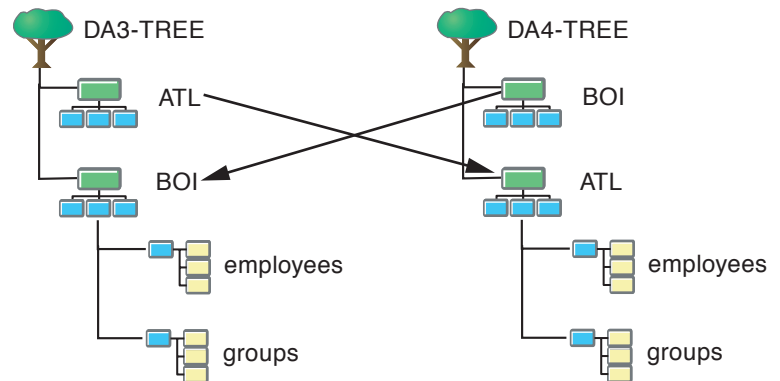
The same is true of the BOI office. BOI needs to create containers for your ATL employees and groups:

**Figure 5-39**



When you and your partner finish installing and starting your eDirectory drivers, employees and groups from your container (such as ATL) will synchronize to the employees and groups containers in your partner's eDirectory tree:

**Figure 5-40**



Do the following:

1. Launch the Mozilla browser.
2. Enter the following URL to access iManager:  
**http://10.0.0.x/nps/iManager**
3. Log in as **admin** with a password of **novell**.
4. On the left under eDirectory Administration, select **Create Object**.
5. On the right from the list, select **Organization**; then select **OK**.
6. Enter the following:
  - ❑ Organization name: *partner office*  
For example, if your partner office is BOI, enter **BOI**.
  - ❑ Context: **DAx-TREE**  
This is the name of your eDirectory tree.  
Use the **Select Object** icon (magnifying glass) to browse to and select your eDirectory tree name. Entering the name from the keyboard can cause errors.
7. When you finish, select **OK**.

A success message appears.

With the organizational container created, you can create the organizational unit containers below it for employees and groups that will be synchronized from your partner office.
8. On the left under eDirectory Administration, select **Create Object**.
9. On the right from the list, select **Organizational Unit**; then select **OK**.

10. Enter the following:
  - ❑ Organizational Unit name: **employees**
  - ❑ Context: *partner office container*  
This is the name of the container you created in step 7.
11. When you finish, select **OK**.
12. Select **Repeat Task**; then enter the following:
  - ❑ Organizational Unit name: **groups**
  - ❑ Context: *partner office container*
13. When you finish, select **OK**.
14. Verify that the containers have been created by selecting **Modify Object** and browsing to the containers.

## Part II: Create the eDirectory Driver for Your Tree

With the containers created to store the employees and groups from your partner office, you are ready to create the eDirectory driver for your tree.

Do the following:

1. Check to make sure the date and time on your NNLS server are current:
  - a. In a terminal session window at the shell prompt, enter **date**.  
The date and time should be current (today's date and time). If not, you can create the eDirectory driver, but will not be able to use it if the date is 90 days or more prior to the current date.

In this step students check the date and time on their NNLS servers to make sure that the date and time are current.

The date should be current (today's date). If not, and the date is more than 90 days in the past, students can import the driver, but it will not work until it is activated.

- b. Do the following:
  - a. If the date is current, continue with the exercise (step 2).
  - b. If the date is not current, log in as root (**su -**), stop the NTP daemon (**/etc/init.d/xntpd stop**), update your server date and time to DA1 (**ntpdate 10.0.0.1**), and start the NTP daemon (**/etc/init.d/xntpd start**).
  - c. Check the date and time by entering **date**. If the date is current, continue with step 2.
  - d. If the date is still not current, **contact your instructor for additional help**.
2. From iManager under DirXML Management on the left, select **Create Driver**.
3. Select **In an existing driver set**; then browse to and select the **DirXML Drivers** driver set object.



---

If you have not completed Exercise 5-2, you will need to select **In a new driver set**, and then follow the steps in that exercise for creating a new driver set.

---

4. When you finish, select **Next**.

A page for importing or creating a driver appears.
5. Make sure **Import a pre-configured driver from the server (.XML file)** is selected.
6. From the drop-down list, select **eDIR-Driver.xml**; then select **Next**.

An eDIR-Driver configuration page appears.
7. For the driver name, keep the default **eDir-Driver** name.
8. Scroll down and enter the following:
  - Remote Tree Address and Port: **your partner office server IP address:8196**

For example if your partner office is BOI (DA4), you would enter **10.0.0.4:8196**.

- ❑ Configure Data Flow: **Bi-directional**
- ❑ Configuration Option: **Flat**
- ❑ Remote Base Container: (leave empty)
- ❑ Base Container: **employees.partner office container** (enter the name; do not use the magnifying glass icon)

For example, if your partner office is BOI, you enter **employees.BOI** for the Base Container.

- ❑ Group Container: **groups.partner office container** (enter the name; do not use the magnifying glass icon)

For example, if your partner office is BOI, you enter **groups.BOI** for the Group Container.

- ❑ Enable PasswordSync: **No**
- ❑ Driver set includes Active Directory or NT driver: **No**

**9.** When you finish, select **Next**.

The eDirectory driver is imported.

**10.** Assign the necessary rights to the eDirectory driver to read and update data in eDirectory:

- a. Select **Define ‘Security Equivalences’**; then select **Add**.
- b. Browse to and select **admin.your container**.
- c. Select **OK**.

**11.** Exclude admin in your tree from being replicated to your partner office DAX-TREE:

- a. Select **Exclude ‘Administrative Roles’**; then select **Add**.
- b. Browse to and select **admin.your container**.
- c. Select **OK**.

**12.** Continue by selecting **Next**.

A Summary page appears.

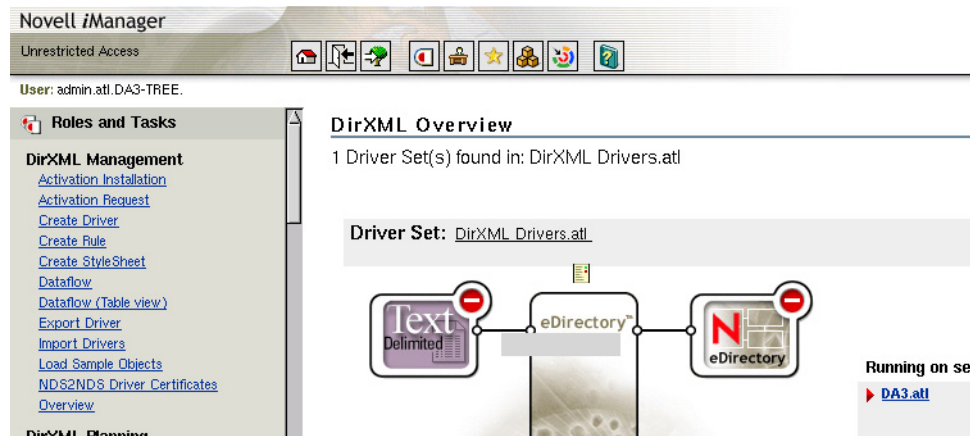
Some students might skip over this step (Define ‘Security Equivalences’). Without admin defined, the eDirectory driver will not synchronize data, even if the student can start the driver.

You can add admin as a security equivalent after the driver is created by modifying the properties of the eDir-Driver object (DirXML: Security Equals).

### 13. Select **Finish with Overview**.

A DirXML overview page appears:

**Figure 5-41**



The minus sign in the red circle indicates the eDirectory driver is stopped. Before starting the driver, you need to wait until your partner has imported and configured an eDirectory driver.

In the meantime, you can check to make sure the DirXML objects were created for your eDirectory driver.

14. At the left under eDirectory Administration, select **Modify Object**.
15. At the right of the Object Name field, select the **Object Selector** icon (magnifying glass); then select **Browse**.
16. Browse to and view the contents of **DirXML Drivers** in *your container*.

You might need to select the **Next** button several times before finding DirXML Drivers.

An eDIR-Driver object appears. This is the driver that you imported and configured.

17. View the contents of the **eDir-Driver** container (select the blue down-arrow to the left of the container name).

You see a Publisher object and a Subscriber object.

18. View the contents of the **Publisher** object.

You see 3 objects for the Create rule, Matching rule, and Placement rule. These are the same rules you saw listed in the Summary screen when you imported and created the driver.

These rules are used to create and place users in your tree coming from your partner office eDirectory tree (through your partner's eDirectory driver subscriber channel).

19. Browse to and view the contents of the **Subscriber** object.

The Subscriber object is empty because no rules have been defined. The Subscriber channel will be used by your eDirectory driver to move employees and groups from your eDirectory tree to the Publisher channel on your partner's eDirectory driver.

20. (Optional) Open one of the Rule objects in the Publisher container and view the configuration.

21. When you finish, select **Cancel**.

### Part III: Explore and Configure Your eDirectory Driver Rules and Filters

With the eDirectory driver installed, let's take a look at the rules and filters that will control the flow of data between your eDirectory tree and your partner office eDirectory tree.

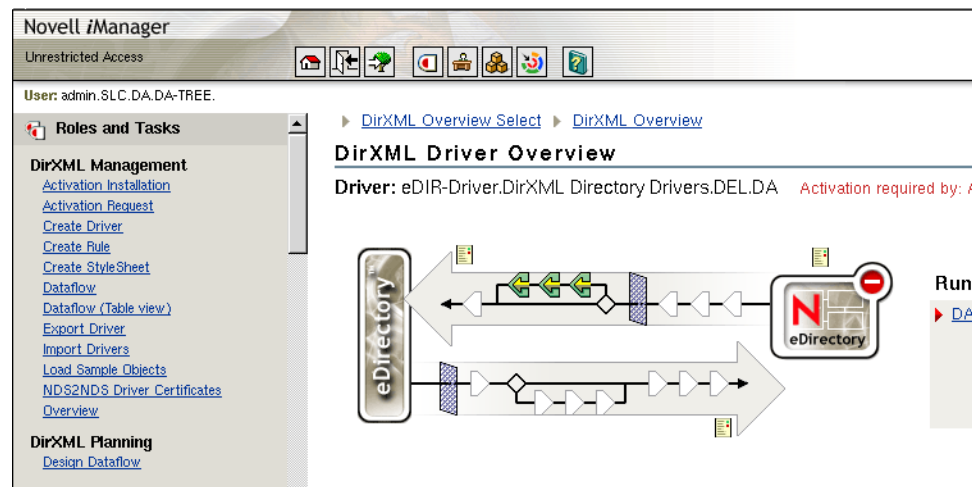
Do the following:

1. On the left under DirXML Management, select **Overview**; then select **Search**.

The DirXML Overview page appears:

2. Select the **eDirectory** driver icon (do not select the red circle).  
The DirXML Driver Overview page appears:

Figure 5-42

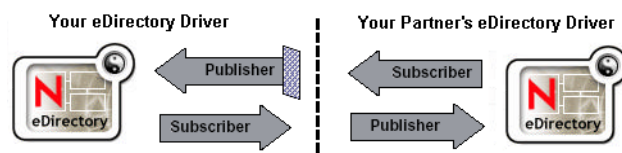


From this page you can tell that there are Placement, Creation, and Matching rules defined for the Publisher channel, and you can see the order in which they process data flowing on the Publisher channel.

You can also access the Publisher and Subscriber filters on your eDirectory driver.

The Publisher channel filter will control the flow of information coming through the Subscriber channel from your partner's eDirectory driver:

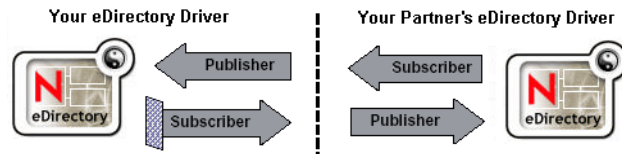
Figure 5-43





The Subscriber channel filter will control the flow of information from your eDirectory tree to the Publisher channel on your partner's eDirectory driver:

**Figure 5-44**



From this overview page you can start and stop the driver, check logs, access filters and rules, and perform other driver maintenance and configuration tasks.

Let's examine the flow of information by checking the Subscriber channel filter on your eDirectory driver.

3. On the DirXML Driver Overview illustration, select the **Subscriber Filter** icon.

A list appears of all the attributes (and their values) that the Subscriber filter allows to flow through the channel to your partner office eDirectory tree.

4. Scroll down through the attributes listed for all classes.

These are attributes that are allowed to pass through the channel for all eDirectory classes in the filter. These include attributes such as Full Name and Given Name that are used by the User class.

Notice that ACL is listed as an attribute. Because most administrators use group memberships to manage rights to different objects in the Directory, they normally remove the ACL attribute in all filters.



---

Removing the ACL attribute is also recommend by Novell because it can contain tree-specific information that might block the synchronization of data through the channel.

---

5. At the top of the attribute list, select **For All Classes In The Filter**.

An Edit Filter dialog appears. On the left are listed eDirectory classes; on the right are the attributes listed for the selected class.

The classes and attributes with check marks are those included in the filter. Remember that only selected attributes and classes can be synchronized.

For All Classes In The Filter is selected with all attributes for all classes listed to the right. Notice that ACL is selected.

6. Deselect **ACL**.
7. Scroll down to and select the **Group** class (make sure you do not deselect the class).

Only attributes associated with Group are now displayed to the right.

Which attributes are selected for Group?

☐

☐

8. Scroll down to and select the **User** class (make sure you do not deselect the class).

Which attribute is selected for User?

☐

Although the list of attributes specifically selected for Group and User is small, other attributes for these classes are already included in the For All Classes In The Filter list.

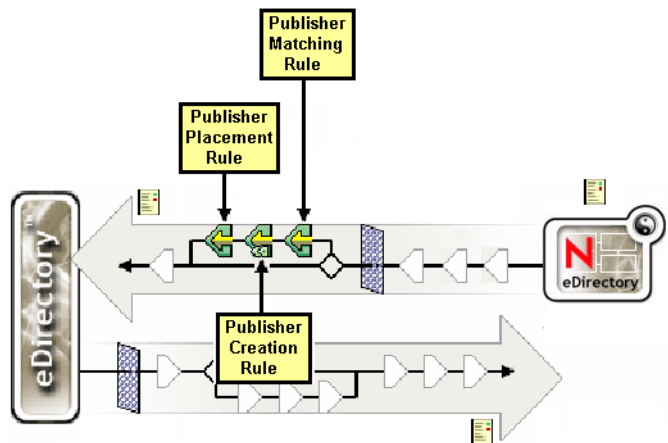
9. Close the Edit Filter dialog by selecting **OK**.

Notice that the ACL attribute is no longer listed. Scroll down and make sure that the Group and User classes are also listed.

10. Close the Subscriber filter dialog by selecting **OK**.
11. You also need to remove the ACL attribute from the Publisher channel filter:
  - a. Select the **Publisher Filter** icon.
  - b. At the top of the attribute list, select **For All Classes In The Filter**.
  - c. Deselect **ACL**.
  - d. Close the Edit Filter dialog by selecting **OK**.  
Make sure that the ACL attribute is no longer listed.
  - e. Close the Publisher filter dialog by selecting **OK**.

Let's review the Matching, Creation, and Placement rules configured on the Publisher channel.

Figure 5-45



The information that flows through the Publisher filter is used by these rules to determine

- If an object already exists in your eDirectory tree that matches the one in your partner office eDirectory tree (Matching rule)
- If enough information passed through the filter to create a new object (Creation rule)
- Where to place new objects in your eDirectory tree (Placement rule)

Let's take a look at the Creation rule.

12. On the Publisher Channel, select the **Creation Rule** icon.

A Creation Rule dialog appears.

13. At the top of the dialog from the drop-down list, select **Edit XML**.

The XML document for the Creation rule appears:

**Figure 5-46**

XML Editor:

```
<?xml version="1.0" encoding="UTF-8"?>
<create-rules>
  <create-rule class-name="User" description="Users">
    <required-attr attr-name="Given Name"/>
    <required-attr attr-name="Surname"/>
  </create-rule>
</create-rules>
```

What 2 attributes are required to create a user object in your eDirectory tree?

A Given Name and Surname are required.

Although both of these attributes are included in the Publisher and Subscriber filters, values for these attributes need to exist in the user object in your partner office eDirectory tree for DirXML to create an equivalent user object in your eDirectory tree.

In addition, a CN value is required by default for both groups and users, which is why the CN attribute is listed for User and Group classes in both filters.

14. Close the Creation Rule dialog by selecting **Cancel**.
15. On the Publisher Channel, select the **Placement Rule** icon.  
A Placement Rule dialog appears.
16. Select **Placement Rule (Users)**; then, from the drop-down list, select **Edit XML**.

An XML document similar to the following appears:

**Figure 5-47**

XML Editor:

```
<?xml version="1.0" encoding="UTF-8"?>
<placement-rules dest-dn-format="slash" src-dn-format="slash">
  <placement-rule description="Users">
    <match-class class-name="User"/>
    <placement>atl\employees\<copy-name/>
  </placement-rule>
  <placement-rule description="Groups">
    <match-class class-name="Group"/>
    <placement>atl\groups\<copy-name/>
  </placement-rule>
</placement-rules>
```

17. Where does the placement rule place users coming from your partner's tree to your eDirectory tree?

Users are placed in *employees.partner office container (partner office container\employees)*, and groups are placed in *groups.partner office container (partner office container\groups)*.

18. Close the Placement Rule dialog by selecting **Cancel**.

#### **Part IV: Synchronize Existing Users and Groups in Your eDirectory Tree to Your Partner Office DAX-TREE**

Before migrating your users and groups to your partner office DAX-TREE, you need to open a second Mozilla browser window to view the results in the partner tree.

Do the following:

1. From the Mozilla browser menu, open a second browser window by selecting **File > New > Navigator Window**.



---

If you are familiar with using Bookmarks or Navigator tabs, you can also set up Mozilla to use the same browser window for both your iManager and your partner office iManager.

You can also press **Ctrl+N** to open a second Mozilla window.

---

A second Mozilla browser window appears.

2. Access iManager for your partner office by entering the following:

**<https://partner office server IP address/nps/iManager>**

For example, if your partner office is BOI (DA4, 10.0.0.4), you enter

**<https://10.0.0.4/nps/iManager>**

3. Log in as **admin** with a password of **novell**.

Novell iManager for your partner office NNLS server appears.




During the next few steps, you use iManager in 2 browser windows. To avoid confusion about which eDirectory tree you are managing, look in the upper left corner of the iManager page for the tree name.

If a student receives an “Error: ‘-295’” when starting the DirXML driver, refer to TID 10085494 to resolve the issue.

With iManager open for both your NNLS server and your partner office NNLS server, you are ready to start your driver and synchronize existing users and groups in your eDirectory tree to the partner office.

4. Switch to your eDirectory iManager window.
5. Start your driver by selecting the **red circle** icon; then select **Start driver**.

After a few moments, the driver starts. A Yin-Yang icon  replaces the red circle.

If the driver does not start, do the following:

- a. From a shell prompt (logged in as root), stop eDirectory by entering **/etc/init.d/ndsd stop**.
- b. When eDirectory stops, start it again by entering **/etc/init.d/ndsd start**.
- c. Make sure eDirectory is running by entering **ndsstat**.
- d. Return to your iManager window and refresh the DirXML Driver Overview page by selecting **Overview** (on the left) and the **eDIR-Driver** icon (on the right).

Notice that the eDirectory driver is started for you because the Startup option default is set to Automatic.

6. At this point, make sure that your partner has successfully started his or her eDirectory driver.  
If not, you will need to wait before continuing the exercise.
7. Check to see if your user and group objects are synchronizing to the employees and groups containers in your partner office eDirectory tree:
  - a. Switch to the iManager window for your partner office.

- b. Under eDirectory Administration, select **Modify Object**.
- c. To the right of the Object Name field, select the **Object Selection** icon (magnifying glass).
- d. Select **Browse**; then browse to *your office container* and check the contents of the employees and groups containers.  
Both containers are still empty.  
Because DirXML is event-driven, an event needs to happen in eDirectory (such as creating or modifying an object) before data is synchronized between the 2 trees.
- e. Select **Cancel**.

To synchronize users and groups between eDirectory trees without generating an event, you can use the Migrate from eDirectory and Synchronize buttons on the DirXML Driver Overview page.

You use Migrate from eDirectory to test the driver (by synchronizing selected objects).

After testing the driver, you can use Synchronize to synchronize all objects defined in the rules between the 2 eDirectory trees.

Let's start by testing synchronization of the WPUSERS group and the members (users) of the group.

- 8. Check the members of the WPUSERS group in your tree:
  - a. Switch to the iManager window for your eDirectory tree.
  - b. Under eDirectory Administration, select **Modify Object**.
  - c. Browse to and select WPUSERS in *your container*; then select **OK**.
  - d. From the drop-down list at the top of the Modify Object page, select **General: Members**.
  - e. You see the following members of the WPUSERS group:
    - ❑ **KWilde.your container**
    - ❑ **LTracy.your container**
    - ❑ **BBell.your container**



These are the employees you will be migrating to your partner office eDirectory tree to test the eDirectory drivers.

- f. Select **Cancel**.
9. Under DirXML Management, select **Overview**.
10. Display the DirXML Overview page by selecting **Search**; then display the DirXML Driver Overview page for your eDirectory driver by selecting the **eDirectory** driver icon.



---

If you notice that your eDirectory driver has stopped running (red circle with a white line), try restarting the driver.

---

11. At the bottom of the DirXML Driver Overview page, select **Migrate from eDirectory**.  
A Migrate data from eDirectory dialog appears.
12. Select **Add**; then browse to *your container* and select **BBell**.
13. Repeat the previous step to add **KWilde** and **LTracy** to the migration list.
14. Migrate the members of the WPUSERS group by selecting **OK**.  
A success message appears indicating that the migration was successfully started.
15. Close the Success dialog by selecting **OK**.
16. Select **Migrate from eDirectory**.
17. Select **Add**; then browse to *your container* and select the **WPUSERS** group.
18. When you finish, select **OK**.  
A success dialog appears.



---

For the members of a group in your local tree to be added successfully to the group object in the remote eDirectory tree, you must migrate at least one member of the group first before migrating the group object.

---

19. Close the success dialog by selecting **OK**.

Although iManager indicated that the migration started successfully, did the user and group actually synchronize to your partner office eDirectory tree?

20. Switch to the iManager window for your partner office tree and use **Modify Object** to verify that the user and group objects synchronized to the employees and groups containers in your partner office eDirectory tree.

All selected users and the WPUSERS group were synchronized to the remote tree.

21. From the iManager window for your partner office, use **Modify Object** under eDirectory Administration to display the properties of **KWilde** in your partner office eDirectory tree.

22. Switch to the iManager window for your eDirectory tree, and use **Modify Object** to display the properties of **KWilde** in *your container*.

The attribute values match between both user objects.

Let's check the association between the 2 objects.

23. From the drop-down list in both iManager windows, select **DirXML: Associations** (at the bottom of the drop-down list).

Notice that there is an association listed between the 2 eDirectory user objects.

This means that the Matching, Create, and Placement rules are no longer needed when synchronizing data between the 2 objects.

Now, let's check the data in the group objects.

24. From your eDirectory iManager window, use **Modify Object** to display the members of the **WPUSERS** group in *your container* (select **Members** from the drop-down list).

25. From your partner office iManager window, use **Modify Object** to display the members of the **WPUSERS** group in *groups.your container* (select **Members** from the drop-down list).

Both group objects contain the same list of members.

Now that you've tested the eDirectory drivers, you're ready to synchronize all users and groups from your tree to the remote tree.

26. From your eDirectory iManager window in the DirXML Driver Overview page, synchronize all your users and groups by selecting the **Synchronize** button (last button to the right).

27. Switch to the iManager window for your partner office eDirectory tree and verify that all the users and groups synchronized.

### Part V: Use the Subscriber Filter to Limit Synchronized Data

After synchronizing all your users and groups from your eDirectory tree to your partner office eDirectory tree, you receive word from IS&T at company headquarters that fax numbers should no longer be synchronized between trees.

What can you do to prevent fax numbers from being synchronized from your tree to your partner office tree?

Try blocking the synchronization of fax numbers by using the Subscriber filter on your eDirectory driver.

Do the following:

1. From your eDirectory iManager window, display the overview diagram for your eDirectory driver.

2. Display the Subscriber filter dialog by selecting the **Subscriber Filter** icon.
3. Display the Edit Filter dialog by selecting **For All Classes In The Filter**.

Which attribute should you deselect to block the fax number from synchronizing to your partner office tree?

4. On the right, scroll down and deselect **Facsimile Telephone Number**.
5. Select **OK**; then select **OK**.
6. Test the Subscriber filter by creating a *user object* in your container in your eDirectory tree:
  - a. Under eDirectory Administration, select **Create Object**.
  - b. From the Available Object Classes list, select **User**; then select **OK**.
  - c. Enter the following employee information:
    - Username: **msmith**
    - First name: **Monica**
    - Last name: **Smith**
    - Context: *your container*
    - Title: **Pilot**
    - Location: *your office location*
    - Department: **Flight Operations**
    - Telephone: **812.888.4321**
    - Fax Number: **812.888.4567**
  - d. When you finish, select **OK**.
  - e. From your partner office iManager window, use **Modify Object** to check the synchronization of the msmith user object and properties.

Notice that the fax number was not included in the data synchronization.

7. Test the Subscriber filter by modifying the telephone number and the fax number of an existing user object in your eDirectory tree; then verify what happens to the associated object in your partner office eDirectory tree.
8. Which number changed? Which number did not change?

Because the Telephone Number attribute is selected in both the Subscriber and Publisher filters, any changes are synchronized between the 2 trees.

However, because the Fascimile Telephone Number attribute is not selected for the Subscriber filter, any changes to the number are not synchronized to the remote tree.
9. (Optional) Try modifying and adding other user or group objects and verify the results.
10. When you finish, close both iManager windows.

## **Part VI: Stop Your eDirectory Driver and Clean Up Your eDirectory Tree**

You've probably noticed that the groups and users in your container are the same as the users and groups synchronized to your partner office container in your eDirectory tree.

To prevent problems with other exercises in this course, you need to stop your eDirectory drive, configure the Startup option, and remove the partner office containers and objects from your eDirectory tree.

Do the following:

1. From your eDirectory iManager window, stop your eDirectory driver and configure the Startup option:

Because you will be deleting employee and group objects that are synchronized (with an association) to employee and group objects in your partner eDirectory tree, stopping the driver prevents the partner objects from being deleted.

- a. On the left under DirXML Management, select **Overview**.
- b. Make sure **Search entire tree** is selected; then select **Search**.
- c. Stop your eDirectory driver by selecting the Yin-Yang icon; then select **Stop driver**.

Although the driver is stopped, it also set to auto start if you reboot your NNLS server. To prevent the driver from starting again, you need to configure the Start option.

- d. Select the **eDIR-Driver** icon.  
The DirXML Driver Overview page appears.
- e. Display the driver configuration page by selecting the **eDIR-Driver** icon again.

A Modify Object window appears.

- f. From the drop-down list, select **DirXML: Driver Configuration**.
- g. Scroll down to the Startup Option heading; then select **Manual**.
- h. Select **OK**.

You are returned to the DirXML Driver Overview page.

You are now ready to delete the partner office containers and objects from your eDirectory tree.

Although most iManager features for NNLS 1.0 are supported in Mozilla, some features are available only from Internet Explorer.

Let's try using Internet Explorer to delete the employee and groups objects.

2. From your Windows XP workstation, start Internet Explorer.
3. Access iManager for your tree (**<https://10.0.0.x/nps/iManager>**) and log in as **admin**.
4. On the left, expand **eDirectory Administration**; then select **Delete Object**.

Notice that iManager in Internet Explorer offers additional features such as selecting multiple objects to manage not currently available in Mozilla.

5. On the right, select **Select multiple objects** (above the Object name field); then select the Object Selector icon (magnifying glass).

A window appears that lets you select more than one object at a time. Each object you select is listed at the bottom of the window.

6. Browse to and select all employee and group objects in your partner office organization container.
7. Select the **employees**, **groups**, and ***your partner office*** containers.
8. When all the objects are listed at the bottom of the window, select **OK**.
9. Delete all the listed objects by selecting **OK** twice.
10. When the deletion process is finished, select **OK**; then close the browser window.

***(End of Exercise)***

## Summary

Objective	Summary
1. Describe the Purpose of DirXML	<p>To describe the purpose of DirXML, you need to know the following:</p> <ul style="list-style-type: none"><li>■ <b>What DirXML Is</b><p>Most companies store data in a variety of directories and databases that are associated with various applications and services and isolated from each other.</p><p>Novell DirXML is a data-sharing service that runs on Novell eDirectory. With DirXML, eDirectory acts as a hub for synchronizing and sharing selected data across the network.</p><p>DirXML provides the following features and benefits:</p><ul style="list-style-type: none"><li>■ Runs on the following Novell eDirectory supported platforms: NetWare®, Windows 2000-, NT, Solaris, and Linux</li><li>■ Allows the administrator to determine the data to be shared</li><li>■ Manages the data relationships between the connected applications</li><li>■ Requires no changes to existing applications</li><li>■ Transforms data into the format required by the target application</li><li>■ Allows DirXML drivers running on 1 platform to communicate with the DirXML engine running on a different platform through the Remote Loader Service</li></ul></li></ul>

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Objective	Summary
1. Describe the Purpose of DirXML (continued)	<ul style="list-style-type: none"><li>■ <b>How DirXML Helps Enterprises Solve Data Synchronization Tasks</b></li></ul> <p>DirXML helps enterprises solve data synchronization tasks by doing the following:</p> <ul style="list-style-type: none"><li>■ Captures changes</li><li>■ Provides a data hub</li><li>■ Provides XML support</li><li>■ Controls data flow</li><li>■ Enforces authoritative data sources</li><li>■ Applies rules to directory data</li></ul>

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Objective	Summary
2. Describe How DirXML Works	<p>DirXML's main purpose is to provide for the clean movement of data between eDirectory and any application, directory, or database.</p> <p>To describe how DirXML works, you need to understand the following:</p> <ul style="list-style-type: none"><li>■ <b>DirXML Architecture</b><p>To describe the DirXML architecture, you need to understand the following:</p><ul style="list-style-type: none"><li>■ DirXML Engine</li><li>■ DirXML Driver</li><li>■ Publisher and Subscriber Channels</li></ul></li><li>■ <b>DirXML Data Processing Components</b><p>The following are the basic components used by the DirXML architecture to process data for synchronization:</p><ul style="list-style-type: none"><li>■ DirXML Filters</li><li>■ Matching Rules</li><li>■ Creation Rules</li><li>■ Placement Rules</li><li>■ Schema Mapping Rules</li><li>■ Transformation Style Sheets</li></ul></li><li>■ <b>Associations</b><p>Associations are created when the Matching rule determines that a new object needs to be created.</p><p>An association solves the problem of different systems having unique identifiers for the same object.</p><p>Each object in eDirectory contains an association table that maps the eDirectory object with a unique identifier for each connected directory or application.</p></li></ul>

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Objective	Summary
2. Describe How DirXML Works (continued)	<ul style="list-style-type: none"> <li>■ <b>DirXML Objects in eDirectory</b> DirXML components are represented as objects in the eDirectory tree. These objects include the following: <ul style="list-style-type: none"> <li>■ Driver Set</li> <li>■ Driver</li> <li>■ Rule</li> <li>■ nadPwdSync</li> <li>■ nadPwdProvider</li> <li>■ nadDomain</li> </ul> </li> </ul>
3. Install the DirXML Starter Pack on Linux	<p>To install the DirXML Starter Pack on Linux, you need to understand the following:</p> <ul style="list-style-type: none"> <li>■ <b>What the DirXML Starter Pack Is</b> The DirXML Starter Pack provides the DirXML engine for Linux and <ul style="list-style-type: none"> <li>■ <b>Licensed drivers.</b> You can install licensed drivers for synchronization of information in NT Domains, Active Directory, and eDirectory.</li> <li>■ <b>Evaluation drivers.</b> Additional drivers are included for your evaluation.</li> <li>■ <b>Password synchronization.</b> A user is required to remember only a single password to log in to any of these systems.</li> </ul> </li> <li>■ <b>How to Install the DirXML Starter Pack on Your Linux Server</b> You need to know how to do the following: <ul style="list-style-type: none"> <li>■ Meet DirXML Dependencies</li> <li>■ Gather Required Information</li> <li>■ Use the NNLS Install Feature</li> <li>■ Locate DirXML Files</li> </ul> </li> </ul>

Objective	Summary
4. Implement the Delimited Text Driver for DirXML	<p>To implement the Delimited Text driver for DirXML, you need to know the following:</p> <ul style="list-style-type: none"><li>■ <b>How the DirXML Driver for Delimited Text Works</b><p>The DirXML driver for Delimited Text is designed to synchronize user data between Novell eDirectory and XML files or delimited text files that contain comma-separated values (CSV files).</p><p>To understand how the driver works, you need to know the following:</p><ul style="list-style-type: none"><li>■ Default Driver Configuration</li><li>■ Default Rules and Style Sheets</li></ul></li><li>■ <b>How to Create and Start the DirXML Driver for Delimited Text</b><p>To create and start your Delimited Text driver, you need to know how to do the following:</p><ul style="list-style-type: none"><li>■ Create and Start the Delimited Text Driver</li><li>■ Activate the Driver</li></ul></li></ul>

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Objective	Summary
5. Implement the eDirectory Driver for DirXML	<p>To implement the eDirectory driver for DirXML, you need to know the following:</p> <ul style="list-style-type: none"><li>■ <b>How the DirXML Driver for eDirectory Works</b><p>The DirXML driver for eDirectory is designed to synchronize objects and attributes between different eDirectory trees (internal or external trees).</p><p>Because you are synchronizing data between eDirectory trees, you always have 2 drivers installed, each in its own tree.</p><p>The Subscriber channel in one tree communicates with the Publisher channel in the other tree.</p></li><li>■ <b>How to Create and Configure the DirXML Driver for eDirectory</b><p>To create and configure your eDirectory driver, you need to know how to do the following:</p><ul style="list-style-type: none"><li>■ Create and Start the eDirectory Driver</li><li>■ Activate the Driver</li><li>■ Configure Secure DirXML Data Transfers</li><li>■ Configure the eDirectory Driver</li></ul></li></ul>



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